LEVITATOR

PERFORMANCE AIRBOAT ENGINES

# OWNER'S OPERATION

# and

# MAINTENANCE MANUAL

*A Division of* PLEASURECRAFT ENGINE GROUP

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PLEASURECRAFT® ENGINE GROUP

LEVITATOR

PERFORMANCE AIRBOAT ENGINES

Thank you for your selection of Pleasurecraft (PCM) Marine Levitator engine for your boating needs. We welcome you to Team PCM, which puts you in the company of tens of thousands of boaters who have relied on Pleasurecraft inboards as their power of choice for over 30 years.

When you chose PCM, you selected the utmost in premium airboat power for your application. Pleasurecraft is the world's largest manufacturer of gasoline marine inboards, and the clear-cut leader in cutting edge technology. Over the years, we have introduced many breakthrough innovations that quickly became industry standards. The pyramidal exhaust system, light-weight transmission, computerized engine control and the Fuel Control Cell (FCC) are all PCM innovations. No matter which PCM model you purchased, you can be sure it is equipped with the latest in modern technology for added performance and durability.

## READ THIS MANUAL THOROUGHLY

Before starting your engine(s), READ THIS MANUAL CAREFULLY AND COMPLETELY. If you do not understand any portion of the manual, contact your Dealer for clarification or assistance. Ask your Dealer for a demostration of actual starting and operating procedures.

The descriptions and specifications contained in this manual were in effect at the time of printing. PCM Engines' policy of continued improvement reserves the right to change specifications or design without notice and without obligation.

This manual will cover the following year of manufacture PCM Levitator Engines:

| Year | Model |
|---|---|
| **2011** | **6.0L HO CES MPI** |
| **2011** | **6.2L ZR550 MPI** |

*** Levitator Clean Emission System is available to reduce emissions without diminishing performance. Levitator CES is patented catalyst technology which uses precious metals to create clean emissions and greatly reduce dangerous carbon monoxide gases.**

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# TABLE OF CONTENTS

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## SAFETY INFORMATION

"Safety Warnings" and additional information or instructions are used to alert the installer/operator of possible safety hazards in performing certain service or maintenance procedures incorrectly or carelessly. DANGERS and WARNINGS are accompanied by the international HAZARD symbol: 

These "Safety Warnings" alone cannot eliminate the hazards that they signal. Strict compliance with these warning instructions while performing service and maintenance procedures, plus "common sense" operation, are major accident prevention measures.

## REPLACEMENT PARTS

**DANGER**

Electrical, ignition and fuel system components are designed and manufactured to comply with U.S. Coast Guard rules and regulations to minimize the possibility of fire or explosion hazard.

Use of replacement parts (i.e. automotive, after-market, etc.) in the electrical, ignition and fuel systems, which are not U.S. Coast Guard approved, could cause a fire or explosion hazard and should be avoided.

Always request that genuine PCM Engines replacement parts be used in any repairs or maintenance being performed on your engine(s).

## SAFETY WARNINGS

**DANGER**

Signals serious damage, failure or breakdown of equipment; severe injury or high probability of death to the user if proper precautions are not taken. This signal word is applied in extreme situations

**WARNING**

Indicates a potential hazard which could result in personal injury.

**CAUTION**

Indicates a hazard which could result in damage to equipment.

**IMPORTANT:** or ***IMPORTANT:*** Used to provide information to perform a procedure more easily.

***WARRANTY NOTICE:*** Indicates a possible warranty exclusion.

## OWNER'S SERVICE AND WARRANTY INFORMATION

### PLEASURECRAFT MARINE ENGINE CO., INC.'S COMMITMENT TO YOU

Pleasurecraft Marine Engine Co. is committed to assuring your satisfaction with your new PCM engine. Your Dealer also wants you to be completely satisfied, and invites you to return for all your servicing needs, both during and after the warranty period.

### OWNER WARRANTY REGISTRATION

It is important that your selling dealer fill out the "Warranty Registration Card" completely and mail it to the factory immediately upon the purchase of the new product. It identifies the name and address of the original purchaser, product model(s) and serial number(s), and the selling dealer's name and address. The dealer is also certifying that you are the original purchaser of the product.

Upon receipt of the "Warranty Registration Card" at the factory, you will be issued an "Owner Warranty Registration Card." The "Owner Registration Card" is your only valid registration identification, and must be presented to the servicing dealer, should warranty service be required.

Along with your Warranty Card you will receive a Customer Survey. We appreciate your feedback and encourage you to fill out the survey after you have had a chance to run your boat for several weeks. We take this input very seriously, and have implemented many of the ideas our customers have given us through this survey. You may also visit our web site at www. pleasurecraft.com.

If your "Owner Registration Card" is not received within 30 days from the date of purchase, please contact your boat dealer or engine seller. The product warranty is not effective until the Product is registered at the factory.

Again, thanks for choosing PCM. We sincerely wish you happy days on the water.

Mail registration information to:

Pleasurecraft Marine Engine Co.
P.O. Drawer 369
Little Mountain, SC 29075

**NOTE: OWNERS WARRANTY REGISTRATION CARD IS LOCATED AT THE BACK OF THIS MANUAL.**

**NOTICE:** Registration lists must be maintained by the factory and dealer on marine products sold in the United States and some foreign countries, should notification under **FEDERAL BOAT SAFETY ACT** be required. It is our desire to have all products registered at the factory, should it ever be necessary to contact you. Make sure your Dealer/Distributor fills out the registration card immediately and sends the card to the factory.

## ENGINE OPERATION AND CARE

Considering the investment that you have made in your new PCM engine, we know you will want to operate and maintain it properly. We urge you to follow the maintenance instructions contained in your engine's "Operation and Maintenance Manual."

If you have any questions on how to keep your engine in good working condition, see your selling dealer, the place where many owners choose to have their maintenance work done. Your dealer can be relied on to use proper parts and practices.

## MAINTENANCE RECORDS

It is recommended that receipts covering the performance of regular maintenance be retained. Damage to your engine, caused by lack of maintenance, is not covered under your warranty. Receipts can be very important if a question arises as to whether a malfunction is caused by lack of maintenance or a defect in material or workmanship. An "Engine Maintenance Log" is provided in the MAINTENANCE SCHEDULE section of the OPERATION AND MAINTENANCE MANUAL for your convenience in recording the service performed.

## LOCAL REPAIR SERVICE

To obtain service or make a claim under your warranty, contact your selling dealer. They have trained technicians, knowledge, special tools, and equipment to properly service your engine, if the need arises. They know you and your boat the best.

## SERVICE AWAY FROM HOME

If you are away from home and your local dealer, and the need for service arises, contact the nearest authorized PCM dealer. Refer to the yellow pages in the telephone directory. If, for any reason, you cannot obtain service, contact Pleasurecraft Marine Engine Co. for referral to the nearest authorized servicing dealer.

## REPLACEMENT PART INQUIRIES

All inquiries concerning replacement parts should be directed to your local authorized dealer. The dealer has the necessary information to order parts for you if they are not in stock. Only authorized distributors can purchase parts from the factory. PCM does not sell to unauthorized dealers or retail customers. When checking on parts, the dealer will require the engine model and serial number to order the correct parts.

## REPLACEMENT SERVICE PARTS

**WARNING**

Electrical, ignition and fuel system components on PCM engines are designed and manufactured to comply with U.S. Coast Guard rules and regulations to minimize the risks of fire or explosion. Use of replacement electrical, ignition or fuel system components, which do not comply with these rules and regulations, could result in a fire or explosion hazard and should be avoided.

When servicing the electrical, ignition and fuel systems, it is extremely important that all the components are properly installed and tightened. If not, any electrical or ignition component opening would permit sparks to ignite fuel vapors from fuel system leaks, if they existed.

## APPLICABLE LIMITED WARRANTY

Following is the limited warranty applicable to PCM Airboat engines sold and used in the United States and Canada.

Distributors and Dealers are not agents of PCM. PCM does not authorize any person to create any other obligation or liability in connection with this product.

**PLEASURECRAFT MARINE ENGINE CO.**
**LEVITATOR ENGINE**
**ONE YEAR LIMITED WARRANTY**

**(For Engines Sold and Used in the United States and Canada Only)**

1. Pleasurecraft Marine Engine Co., Inc., (hereinafter referred to as "PCM") warrants each of its new inboard marine engines and accessories attached thereto ("Products"), to be free from defects in material and workmanship for a period of 200 hours of operation or twelve (12) calendar months, six (6) calendar months in commercial use, except to the extent limited herein. This Limited Warranty commences FROM THE DAY OF DELIVERY REQUIRED TO BE ENTERED BELOW AT THE TIME OF DELIVERY TO THE PURCHASER; however, in no event shall the duration of the Limited Warranty exceed one (1) year, as measured from the original retail sale date.

2. Under this Limited Warranty, PCM's obligation is limited to repairing or replacing those parts of Products that have become defective within the applicable warranty period, because of defective materials or workmanship. PCM will arrange for the correction of all defects under this Limited Warranty to be made free of charge at the selling dealership or an authorized PCM service center. PCM, at its discretion, may provide for the repair or replacement of any defective part at PCM's facility. PCM will make payment for labor to replace such parts as provided in the, then, current flat rate labor manual or Warranty Procedures Manual.

3. This Limited Warranty does not apply to Product defects caused by normal wear and tear to Products, and/or damage to Products arising out of negligence or lack of proper care, improper installation or service, operation with fuels, oils or lubricants which are not suitable for use with Products, alterations or removal of parts, water entering an engine through the exhaust system or carburetor, installation of accessories or parts not manufactured or sold by PCM, or Products rendered defective by accident.

4. If a part should become defective within the applicable warranty period, advance authorization by PCM is necessary before the part is replaced or a defect is corrected by a service representative; otherwise PCM will not be liable for the expense of the replacement or correction.

5. Replacement parts and accessories supplied by PCM, and installed on a Product during the period when the Product is covered under the provisions of this Limited Warranty, are warranted for the unexpired portion of the existing warranty period, or ninety (90) days from the date of installation of such new parts or accessories, whichever is longer.

6. Reasonable access to the Product must be provided for warranty service. This Limited Warranty does not cover: (1) telephone or telegram charges, towing charges, storage, launch and haul out charges, loss or damage to personal property, loss of revenue, loss of time, travel, lodging, inconveniences or other CONSEQUENTIAL DAMAGES, or (2) removal and/or replacement of boat partitions or material, because of boat design, for necessary access to the Product.

7. **NO OTHER WARRANTY GIVEN**

   **THE OBLIGATIONS SET FORTH IN THE PRECEDING PARAGRAPHS ARE PCM'S SOLE OBLIGATIONS AND OWNER/USER'S EXCLUSIVE REMEDY. PCM MAKES NO OTHER WARRANTY, EXPRESS OR IMPLIED (except to the extent provided in the immediately following paragraph), AND MAKES NO WARRANTY OF MERCHANTABILITY OR FITNESS FOR PARTICULAR PURPOSE.**

   **However, to the extent that any warranty may be implied by law, the term of such implied warranty shall be limited to a period of time corresponding to the period of express warranty applicable to the particular Product, and its use by the owner/user, as set forth herein, commencing on the date of the first retail sale of the Product to the first registered owner or registered user. Some states do not allow limitations on how long an implied warranty lasts, so the above limitation may not apply to you.**

**This is the sole warranty provided respecting PCM's Products, and no other party may make a warranty to owner/user.**

**PCM SHALL NOT BE LIABLE FOR ANY LOSS OF TIME, INCONVENIENCE, COMMERCIAL LOSS OR DIRECT OR INDIRECT, INCIDENTAL (except as specifically provided herein) OR CONSEQUENTIAL DAMAGES. Some state do not allow the exclusion or limitation of incidental or consequential damages, so this limitation or exclusion may not apply to you. This Warranty gives you specific legal rights, and you may also have other rights which vary from state to state.**

Any owner/user hereby waives for himself/herself/itself and his/her/its successors and assigns (a) any and all claims for punitive damages, and (b) all claims of negligence or strict liability or both. In no event will PCM's liability exceed the purchase price of the Products which is actually paid to PCM.

8. To make a claim under this Limited Warranty, contact the selling dealer from which your PCM powered boat was originally purchased or the nearest authorized PCM servicing dealer. It is recommended that your warranty service be performed by the dealer which sold the Product to you because of that dealer's personal interest in you as a customer. Your PCM powered Product must be delivered to the servicing dealer within the applicable warranty period. Proof of purchase may be required by the PCM dealer to substantiate any warranty claim. Use your PCM Owner Warranty Registration Card to establish proof of purchase.

### 9. ITEMS NOT COVERED UNDER LIMITED WARRANTY

This Limited Warranty is limited to defects in material and workmanship. To avoid misunderstandings regarding warranty coverage, the following describes some, but not all, of the more common types of service that are not covered by this Limited Warranty.

- Normal service requirements arising during the warranty period, such as fuel system or ignition adjustments, tune-ups, filter, adjusting controls or lubrications.
- Damage caused by neglect, lack of maintenance, abnormal operation accident or improper installation or service.
- Normal wear of the piston rings, cylinders, water pump and other engine and transmission parts.
- Haul out, launching, towing charges, dockage or storage fees, removal and/or replacement of boat partitions or material, because of boat design, for necessary access to the product.
- All related transportation charges and/or travel time.
- The cost of shipping replacement parts by air freight or other premium freight methods.
- Additional service work requested by the customer or performed by the dealer other than that necessary to satisfy the warranty obligation.
- Labor performed by other than an authorized dealer may be covered only under the following circumstances: when performed on an emergency basis (providing there are no authorized dealers in the area who can perform the work required, and prior factory approval has been given to have the work performed at this facility).
- Damage from participating in, or preparing for, racing or other competitive activity.
- Water entering the engine cylinders or oiling system through the intake manifold system, exhaust system, submersion, or in any manner if not caused by a PCM manufacturing defect.
- Water in starters.
- Improper winterizing resulting in freezing and breaking of the engine block, cylinder heads, exhaust manifolds, heat exchanger or other damage.
- Repairs made necessary by normal wear, rust, electrolysis or corrosion, or by the use of the parts or accessories which are either incompatible with the PCM product or adversely affect its operation, performance or durability.
- Valve or valve seat grinding required because of wear.

- Failure or damage due to lack of cooling water caused by starting the Product out of the water or by foreign material blocking the water inlets.
- Cleaning of the engine fuel system due to water or dirt contamination of the boat fuel system.
- Use of fuel and lubricants which are not suitable for use with or on the Product. Refer to the Operation and Maintenance Manual.
- Damage to the engine and/or transmission caused by striking a submerged object. (This is considered a marine hazard).

10. This Limited Warranty shall be governed by, and construed and interpreted in accordance with, the laws of the State of Ohio, without application of its conflicts of laws principles, except only to the extent replaced or precluded by other law of mandatory application.

**11. SPECIAL STATE LEGAL REQUIREMENTS**

This Warranty gives you specific legal rights, and you may also have other rights which vary from State to State.

The PCM California Model Years Emissions Warranty and California Emission Control Warranty Statement is a separate document included in this Manual. Any questions concerning the Emissions Warranty can be obtained by calling 1-803-345-0050.

## THINGS YOU SHOULD KNOW ABOUT THE WARRANTY

### Warranty Repair Component Exchanges

In the interest of customer satisfaction, PCM may offer an exchange service on some engine components. This service is intended to reduce the amount of time that your boat is not available for use, due to repairs. Components used for the exchange service may be new, remanufactured, reconditioned or repaired, depending upon the component involved. All exchange components used meet PCM standards and are warranted the same as new components.

### Production Changes

PCM and its Distributors reserve the right to make changes in the engines built and/or sold by it at any time without incurring any obligation to make the same or similar changes on engines previously built and/or sold.

### Proof of Date of Purchase

PCM will accept the return of a properly filled out “Warranty Registration Card”, supplied with each engine, as proof of purchase. Failure of purchaser to return such card will require the owner to provide a copy of the original “Bill of Sale” (sales contract) for the Product to be serviced. Warranty claims will not be accepted until adequate “Proof of Purchase” is presented by the purchaser, and the date of purchase is substantiated.

### Access to Product

Reasonable access must be provided to the Product for warranty service. The warranty does not cover the removal and/or replacement of boat partitions and/or other components which must be removed for necessary access to the Product.

## FEDERAL/CALIFORNIA EMISSION CONTROL WARRANTY STATEMENT
## YOUR WARRANTY RIGHTS AND OBLIGATIONS

The Environmental Protection Agency (EPA), California Air Resources Board (CARB) and Pleasurecraft Marine Engine Co. (hereinafter “Pleasurecraft”) are pleased to explain the emission control system warranty on your inboard marine engine manufactured after January 1, 2008 for CARB and after January 1, 2011 for EPA. Federally, new inboard engines must be designed, built and equipped to meet EPA and CARB’s emissions and stringent anti-smog standards. Pleasurecraft must warrant the emission control system on your inboard engine for the periods of time listed below provided there has been no abuse, neglect or improper maintenance of your inboard engine.

Your emission control system may include parts such as the carburetor or fuel injection system, the ignition system, and catalytic converter. Also included may be hoses, belts, connectors and other emission-related assemblies.

Where a warrantable condition exists, Pleasurecraft will repair your inboard engine at no cost to you, including diagnosis, parts and labor.

### MANUFACTURER’S WARRANTY COVERAGE:

Select emission control parts from inboard marine engines manufactured after January 1, 2008 for CARB and after January 1, 2011 for EPA are warranted for 3 years or 480 hours, whichever first occurs.

However, warranty coverage based on the hourly period is only permitted for engines that are equipped with appropriate hour meters as defined in § 2441(a)(13) or their equivalent. If any emission related part on your engine is defective under warranty, the part will be repaired or replaced by Pleasurecraft.

### OWNER’S WARRANTY RESPONSIBILITIES:

– As the inboard engine owner, you are responsible for the performance of the required maintenance listed in your owner’s manual. Pleasurecraft recommends that you retain all receipts covering maintenance on your inboard engine, but Pleasurecraft cannot deny warranty solely for the lack of receipts or your failure to ensure the performance of all scheduled maintenance.

– As the inboard engine owner, you should however be aware that Pleasurecraft may deny you warranty coverage if your inboard engine or a part has failed due to abuse, neglect, improper maintenance or unapproved modifications.

– You are responsible for presenting your inboard engine to an authorized Pleasurecraft dealer as soon as a problem exists. The warranty repairs will be completed in a reasonable amount of time, not to exceed 30 days.

If you have any questions regarding your warranty rights and responsibilities, you should contact Pleasurecraft at 1-803-345-0050.

## PLEASURECRAFT MARINE ENGINE CO. GENERAL EMISSIONS WARRANTY COVERAGE (Engines Manufactured after January 1, 2008 for CARB and after January 1, 2011 for EPA)

**1.** Pleasurecraft Marine Engine Co. (hereinafter referred to as “Pleasurecraft”) warrants to the first owner purchasing at retail, and all subsequent owners, of every Pleasurecraft inboard marine engine manufactured after January 1, 2008 for CARB and after January 1, 2011 for EPA, that the emissions control devices on Pleasurecraft inboard marine engines are free from defects in materials and workmanship when manufactured and will remain so for a period of three (3) years or 480 hours, whichever first occurs, from the date of delivery to the first owner purchasing the engine at retail or from the date the engine is first placed into service for demonstration or any other purpose prior to sale to the first owner purchasing the engine at retail.

2. Pursuant to the Environmental Protection Agency 40 CFR Part 1045 and Part 1068 and the California Code of Regulations Title 13, Chapter 9, Article 4.7§ 2445.1, Pleasurecraft warrants that each Pleasurecraft engine is designed, built and equipped to conform with all applicable regulations adopted by the Environmental Protection Agency and the California Air Resources Board pursuant to its authority in Chapters 1 and 2, Part 5, Division 26 of the Health and Safety Code, and is free from defects in materials and workmanship that cause the failure of a warranted part to be identical in all material respects to that part as described in Pleasurecraft’s application for certification.

3. Any part covered under this Warranty that is not scheduled for replacement as required maintenance, in the written instructions to be found within the Pleasurecraft Owners/Operators Manual, is warranted for the period of three (3) years or 480 hours, whichever first occurs. If the part fails during the period of warranty coverage, Pleasurecraft will repair or replace the defective part at any Pleasurecraft warranty station. The repair or replacement will be performed at no charge to the owner. Any such part repaired or replaced under this Warranty will be warranted for the remainder of the three (3) year or 480 hours, whichever first occurs, period.

4. Any part covered under this Warranty that is scheduled only for regular inspection in the written instructions to be found within the Pleasurecraft Owners/Operators Manual, is warranted for the period of three (3) years or 480 hours, whichever first occurs. If the part fails during the period of warranty coverage, Pleasurecraft will repair or replace the defective part at any Pleasurecraft warranty station. The repair or replacement will be performed at no charge to the owner. Any such part repaired or replaced under this Warranty will be warranted for the remainder of the three (3) year or 480 hours, whichever first occurs, period.

5. Any part covered under this Warranty that is scheduled for replacement as required maintenance in the written instructions to be found within the Pleasurecraft Owners/Operators Manual will be warranted for the period of time before the first scheduled replacement date for that part. If the part fails before the first scheduled replacement, Pleasurecraft will repair or replace the defective part at any Pleasurecraft warranty station. The repair or replacement will be performed at no charge to the owner. Any such part repaired or replaced under this Warranty will be warranted for the remainder of the period prior to the first scheduled replacement date for the part.

6. Replacement of any part under this Warranty with a Pleasurecraft supplied part, will not shorten nor extend the warranty period(s) stated in paragraphs one (1) thru four (4) above.

7. The engine owner will not be charged for diagnostic labor that is directly associated with diagnosis of a defective, emission-related warranted part, provided that such diagnostic work is performed at a Pleasurecraft warranty station.

8. To insure prompt repair under this Warranty, Pleasurecraft will maintain a supply of warranted parts sufficient to meet the expected demand for such parts. Any replacement part may be used in the performance of any warranty maintenance or repairs and will be provided by Pleasurecraft without charge to the owner.

9. Parts covered under this Warranty are:

1. Fuel Metering System
   - A. Fuel Injectors
   - B. Fuel Pressure Regulator
   - C. Manifold Absolute Pressure Sensor
   - D. Throttle Position Sensor
   - E. Throttle Body - Port Fuel Injection Models
   - F. Coolant Temperature Sensor
   - G. Intake Valves
   - H. Oxygen Sensors
2. Air Induction System
   - A. Intake Manifold
   - B. Air Filter (Flame Arrestor)
3. Ignition System
   - A. Spark Plugs
   - B. Electronic Ignition System
   - C. Ignition Coil and/or Control Module
   - D. Ignition Wires
4. Lubrication System
   - A. Oil Pump and Internal Parts
5. Positive Crankcase Ventilation (PVC) System
   - A. PCV Valve
   - B. Oil Filler Cap
6. Exhaust System
   - A. Exhaust Manifold(s)
   - B. Exhaust Riser(s)
   - C. Exhaust Valves
   - D. Catalytic Converters
7. Miscellaneous Items Used on Above Systems
   - A. Hoses, clamps, fittings, tubing, sealing gaskets or devices and mounting hardware
   - B. Electronic Controls
   - C. Electronic Control Module
   - D. Pulleys, belts and idlers

10. Exclusions: The repair or replacement of any warranted part otherwise eligible for coverage under this Warranty may be excluded from such warranty coverage if Pleasurecraft demonstrates that the engine and/or part has been abused, neglected, or improperly maintained, and that such abuse, neglect, or improper maintenance was the direct cause of the need for repair or replacement of the part.

11. Pleasurecraft original equipment parts are “identical in all material respects to that part as described in the engine manufacturer’s application for certification”. The use of any replacement parts not supplied by Pleasurecraft may not meet this requirement and will be grounds for disallowing a claim made under this Warranty. Pleasurecraft will not be liable under this Warranty or provide warranty coverage for product failures caused by parts other than Pleasurecraft original equipment parts.

12. If you have any questions regarding your warranty rights and responsibilities, or the location of Pleasurecraft warranty stations near you, you should contact Pleasurecraft at 1-803-345-0050.

## SAFETY INFORMATION

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These "Safety Warnings" alone cannot eliminate the hazards that they signal. Strict compliance with these warning instructions while performing service and maintenance procedures, plus "common sense" operation, are major accident prevention measures.

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Always request that genuine PCM Engines replacement parts be used in any repairs or maintenance being performed on your engine(s).

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# BOATING RESPONSIBILITIES - 2

## CARBON MONOXIDE HAZARD

**DANGER**

**Carbon Monoxide (CO) is a colorless, odorless and tasteless gas. You cannot see it, smell it or taste it. Prolonged exposure to carbon monoxide can lead to unconsciousness, brain damage or death!**

Carbon monoxide is produced when anything that contains carbon, such as gasoline, natural gas, oil, propane, coal or wood is burned. Carbon monoxide is commonly found in the exhaust of internal combustion engines (boat power plants, generators, etc.). In addition, open flame devices like cooking ranges, heaters and charcoal grills also produce carbon monoxide.

Carbon monoxide accumulation, in and around boats is affected by vessel geometry; overall vessel design; closeness to other structures; wind direction; boat speed; and many other variables. In no way can this section cover all of the possible variables. Do not rely on this section as the exclusive listing of measures to prevent the accumulation of carbon monoxide.

Consult your boat operators manual for detailed information on the inspection and/or maintenance of the exhaust system for your particular application. If an inspection reveals possible leaks, DO NOT operate your engine(s) until it can be serviced by a qualified technician.

Proper and adequate air circulation, around and throughout the boat, is absolutely necessary to aid in the prevention of carbon monoxide build-up. If you have any questions or concerns regarding the operation of your boat and carbon monoxide hazards, DO NOT operate your engines until you have contacted your boat manufacturer.

To find out more about making boating safer, including how you can prevent carbon monoxide poisoning on recreational boats, contact:

**National Marine Manufacturers Association**
200 East Randolph Drive
Suite 5100
Chicago, IL 60601-6528
www.nmma.org
312-946-6200

**United States Coast Guard**
Office of Boating Safety
CG Headquarters G-OPB-3
2100 Second Street SW
Washington, DC 20593
www.uscgboating.org
202-267-0984

**American Boat & Yacht Council, Inc.**
3069 Solomon's Island Road
Edgewater, MD 21037-1416
www.abyc.com
410-956-1050

## SAFE BOATING SUGGESTIONS

The nation's waterways are becoming increasingly crowded and, in order to enjoy them safely, the operator should acquaint himself/herself with safe boating practices. Boating safely and seamanship courses are offered by the following national and state organizations:

- Power Squadrons
- Coast Guard Auxiliary
- Red Cross
- State, provincial or local agencies in charge of water safety enforcement

PCM Engines highly recommends that all power boat operators attend one of these courses. To help locate a course being offered near you, contact Boat U.S. Foundation's toll-free national boating safety hotline, 1-800-336-BOAT, and in Virginia, 1-800-245-BOAT.

## WATER WISDOM

The following are suggestions for safe operation of your boat to ensure the safety of yourself and your passengers:

- Know your boat's loading and operating limitations. DO NOT OVERLOAD!
- Make periodic checks of safety equipment onboard.
- Do not consume alcoholic beverages or take illegal drugs when operating a boat. Some state laws apply to boats as well as motor vehicles.
- File a "float plan." Let someone know your destination and your expected time of return.
- Monitor the weather. Know the signs of weather change and avoid severe weather and rough seas whenever possible.
- Follow the "Rules of the Road" when boating. Always be on the alert and watch out for "the other guy."
- Plan and chart your course. Be aware of, and avoid, hazardous areas.
- Be sure your boat is equipped with the required safety equipment. Check with the Coast Guard and local government agencies as to the regulations and restrictions in your area. Contact your local Coast Guard Auxiliary and take advantage of their seasonal boat inspections.

The following is a list of suggested safety equipment and spare parts which may be useful in case of an emergency:

- Approved personal flotation devices (life jackets); one for each person on board.
- Approved throwable personal flotation device for man-overboard protection.
- Approved fire extinguishers
- Signal devices: flares, spotlight, signal flag and horn or whistle
- PCM Engines' "Onboard Kit," plus spare fuses, bulbs, batteries, etc. Tools necessary for minor repairs
- Spare propeller
- Anchor and anchor line
- First aid kit and first aid book
- Ship-to-shore radio, compass and chart of the area in which you are traveling
- Manual bilge pump and spare drain plugs
- Waterproof storage containers

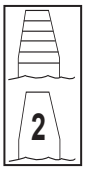
## OPERATION AND MAINTENANCE

It is the owner's/operator's responsibility to perform all safety checks before operating his/her boat. All lubrication and maintenance schedules must be adhered to assure optimum performance and dependability from your PCM engine. When service and maintenance are required, return to your authorized PCM Engine Dealer.

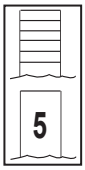
# BOATING RESPONSIBILITIES - 2

## RULES OF THE ROAD
### Channel Buoy Guide

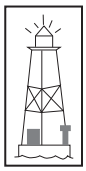
The color of the paint is the only characteristic which has the same meaning on all buoys. Red buoys always indicate the starboard side of the channel from seaward. (Red Right Returning)




1. **Nun Buoy:** This buoy indicates the starboard side of the channel when returning from sea. It is conical shape, the color red and indicates even numbers. A nun buoy with red and green horizontal bands (top band red), and not numbered, indicates an obstruction. The principal channel is to the left of the buoy when returning from sea.

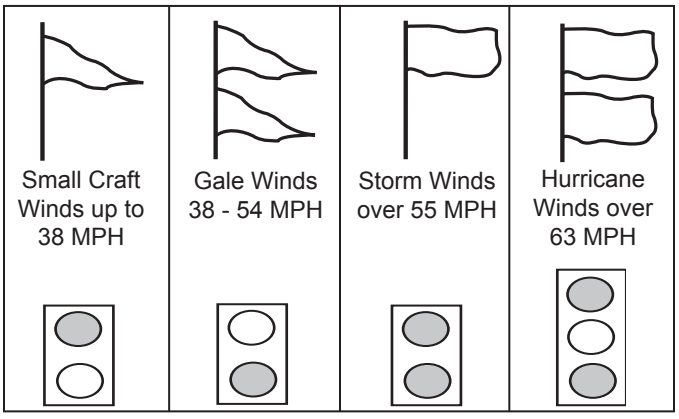



2. **Can Buoy:** This buoy indicates the port side of the channel when returning from sea. It is cylindrical shape, the color green and indicates odd numbers. A can buoy with green and red horizontal bands (top band green), and not numbered, indicates an obstruction. The principal channel is to the right of the buoy when returning from sea.



3. **Lighted Buoy (RED):** This buoy has a flashing red light. It indicates the starboard side of the channel when returning from sea.

4. **Lighted Buoy (GREEN):** This buoy has a quick flashing green light. It indicates the port side of the channel when returning from sea. The quick flashing light indicates special caution required.



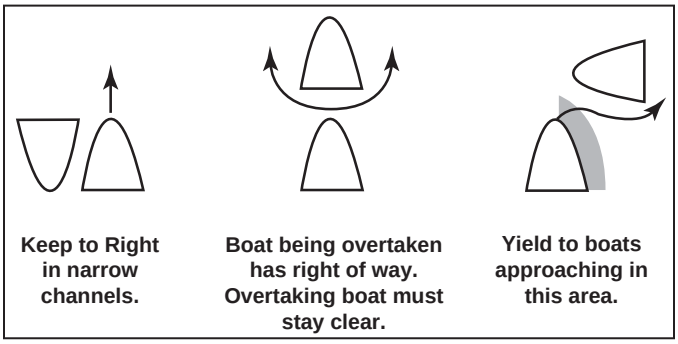

**Storm Warning Signals - Pennants (by day)**
**Lights (by night)**

### Boat Capacity

- Load only to manufacturer's specifications
- Distribute load evenly; keep it low
- Passengers should only ride on the parts of the boat that are designed for that purpose
- If water is rough, carry fewer passengers

### Observe the Rules of the Road

PORT (Left) - Leaving the harbor with green buoys to your right.
STARBOARD (Right) - Entering the harbor with red buoys to your right.




### Know Your Horn Signals

1 Short Blast = Passing you on my port side
2 Short Blasts = Passing you on my starboard side
3 Short Blasts = I am going astern
5 Short Blasts = Danger
**Always refer to the latest U.S. Coast Guard Navigation Rules CG-169**

### Keep An Alert Lookout For:

Bad weather, Swimmers, Other boats, Water skiers, Fisherman, Divers and/or any other obstructions

**Keep Your Wake Under Control,** particularly upon entering or leaving harbor areas. You are responsible for wake damage to other vessels and/or property.

### Do Not Fool With Fuel

**1/2 pint of gasoline = 15 sticks of dynamite**

1. During fueling, moor boat properly; remove all passengers.
2. Keep all doors, hatches and ports closed.
3. Shut down all electronic gear; extinguish galley fires, pilot lights and smoking materials.
4. Do not overload tanks.
5. Keep filling nozzles in contact with the fill pipe to prevent sparks.
6. Secure the fill cap tightly; wipe away any spillage.
7. Ventilate all components for a minimum of five minutes before starting engines.
8. Keep fuel lines and bilges clean.

## ENGINE IDENTIFICATION

When ordering service parts or obtaining information, always give the engine model and the serial number. This information can be found on the following decal.

PLEASURECRAFT MARINE ENGINE CO.
MODEL SERIAL
FIRING ORDER MFR DATE:
THIS ENGINE CONFORMS TO ALL APPLICABLE U.S. GOVERNMENT STANDARDS AND INTERNATIONAL BODENSEE SHIPPING COMMISSION
STANDARD CERTIFICATION NO. (M14) 34 1 01 01
FOR MARINE ENGINES AT THE DATE OF MANUFACTURE.
LITTLE MOUNTIAN, SC 29075
CE

***Figure 3-1*** Engine Identification Decal

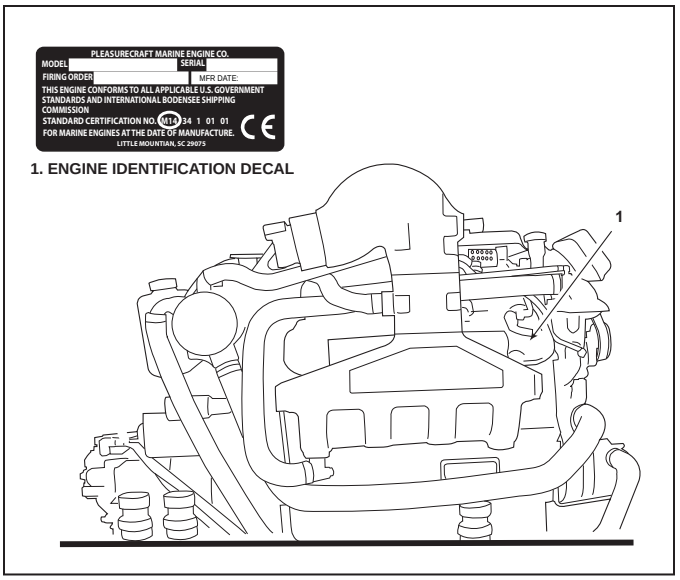



***Figure 3-2*** Engine Identification Tag Location (Typical)

## OWNER IDENTIFICATION AND REGISTRATION INFORMATION

We suggest that you record the following information for quick reference when ordering parts or requesting service or warranty.

| | SINGLE / PORT | STARBOARD |
|---|---|---|
| **Engine Model Number:** | | |
| **Serial Number(s):** | | |
| **Gear Model Number:** | | |
| **Serial Number(s):** | | |
| **Boat Make:** | | |
| **Boat Model:** | | |
| **Hull Serial Number:** | | |
| **Propeller Size:** | | |
| **Ignition Key Number:** | | |

# LEVITATOR
# MODEL IDENTIFICATION / ADVISORY

MODEL **08 - 6 0 3 - 0 1** SERIAL **515000**

1st - 2nd Space: **MANUFACTURING CODE**

3rd - 5th Space: **ENGINE CODE**
**603** = 6.0L HO(366 CID MPI) (L96 Base) (GM)
**620** = 6.2L(Supercharged MPI) (GM)

6th - 7th Space: **DRIVE CONFIGURATION**
blank - Direct Drive
**C** - Clean Emissions System (CES)

8th - 9th Space: **SPECIFICATION CODE**

***SERIAL NUMBER I.D.***
1st DIGIT INDICATES DECADE ENGINE WAS MANUFACTURED ( 3 = 1990, 4 = 2000, 5 = 2010 )
2nd DIGIT INDICATES CALENDAR YEAR ENGINE WAS MANUFACTURED.

## ELECTRONIC FUEL INJECTION SYSTEM

The PCM Engines covered in this manual are equipped with an Electronic Fuel Injection (EFI) system, which allows precise control of fuel and spark delivery. The fuel system components of the EFI system are:

- The electric fuel pumps
- The throttle body assembly
- The fuel injectors
- Boost Control Solenoid (Supercharged engines ONLY)

The fuel injection system is controlled by an Electronic Control Module (ECM). The ECM is the decision center of the system. The ECM constantly monitors information from various sensors on the engine, and electronically processes the information, in order to control ignition timing and fuel delivery for optimum performance and fuel economy. The ECM incorporates an engine overspeed protection, calibrated to a specific RPM, to prevent engine damage from over-revving.

The sensors that the ECM monitors are:

- Engine Coolant Temperature (ECT) Sensor
- Throttle Position (TP) Sensor
- Manifold Absolute Pressure (MAP) Sensor
- Knock Sensor (KS) System
- Crankshaft Positioning (CKP) Sensor
- Camshaft Positioning (CMP) Sensor
- Intake Air Temperature (IAT) Sensor
- Throttle Control Position (TCP) Sensor

**Additional Sensors for CES ENGINES**

- Pre-Catalyst Oxygen ($O_2$) Sensors
- Post-Catalyst Oxygen ($O_2$) Sensors

If, for any reason, one or more of these sensors or associated wiring malfunctions, the ECM's built-in self-diagnostic system sets a trouble code and turns on the "MIL" Malfunction Indicator Lamp to alert the operator of a malfunction.

In most cases, when the "MIL" is on, the engine(s) may lose some performance and/or efficiency, but remain running adequately. Also, the light may go out or become intermittent, but a trouble code will be logged for future diagnosis. (See Engine Alarm System - page 16)

In any case, the operator must obtain service by an authorized PCM Premier dealer to determine the exact cause of the malfunction.

## ENGINE ALARM SYSTEM

The PCM engine electronic system is programmed to control the engine alarm system. This system utilizes an indicator lamp (“MIL” or “Check Engine”) and/or an optional audible alarm to warn the operator of possible engine problems.

The alarm circuit has a “self” checking feature programmed into the system. This feature will momentarily light the “MIL”, and if equipped, sound the alarm for two short pulses upon initial start-up of the engine.

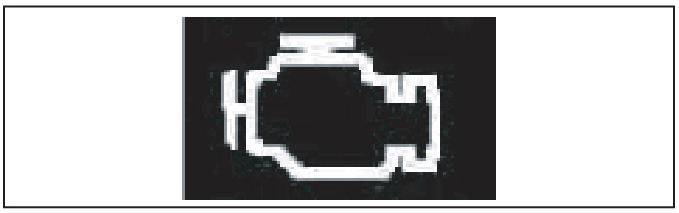
If the “MIL” lights and/or the alarm sounds during operation, observe the instrument panel readings for the possible source of the malfunction, such as low oil pressure or excessive engine temperature readings.

Other conditions that may sound the warning buzzer are a transmission over-temperature warning (if equipped), exhaust gas over-temperature warning (if equipped), and for an electronic throttle malfunction.

## ENGINE ALARM SYSTEM (CES ENGINES)

The PCM engine electronic system is programmed to control the engine alarm system. Your CES Engine Alarm System may utilize up to three (3) alarm circuits to warn you of a potential problem with your engine.

The Malfunction Indicator Lamp (MIL) is used for notification of any emissions-related fault. This is an amber indicator lamp, that may be labeled ‘Service Soon’ or with the ISO icon, to warn the operator of possible engine problems.



ISO Icon

The Check Gauges Lamp (CGL) is used for notification of any non-emissions-related fault. This is a red indicator lamp to warn the operator of possible engine problems such as low oil pressure or an over temperature condition.

The Buzzer is an audible notification to the operator, that may be used in conjuction with the MIL and/or CGL.

For events such as an engine over-temperature condition, low oil pressure, etc., the Buzzer will sound for 1/2 second ON, 1/4 second OFF, continuously as an audible warning. For emissions related faults (MIL), the buzzer will initially sound for 5 seconds, then will sound for 1/2 second ON once per minute thereafter. In the event of a MIL circuit failure, MIL circuit functions will be transferred to the Buzzer circuit.

The alarm circuit has a “self” checking feature programmed into the system. This feature will light the “MIL” and “CGL” lamps, and also sound the buzzer for two short pulses upon initial start-up of the engine.

**NOTE:** If, during Key ON, engine OFF, either the MIL or CGL lamps are flashing, this indicates that a stored trouble code or engine fault is recorded in the ECM. Refer to your dealer for proper diagnosis.

If the “MIL” or “CGL” lights and the alarm sounds during operation, observe the instrument panel readings for the possible source of the malfunction, such as low oil pressure or excessive engine temperature readings.

Other conditions that may sound the warning buzzer are a transmission over-temperature warning (if equipped), exhaust manifold water over-temperature warning , and for an electronic throttle malfunction.

**IMPORTANT:** A failure involving the Electronic Throttle may result in ***Idle only*** operation of the engine. The operator must obtain service by an authorized PCM Premier dealer to determine the exact cause of this malfunction as soon as possible.

In most cases, when the “MIL” or “CGL” lights are on, the engine may lose some performance and/or efficiency, but remain running adequately. Also, the lights may go out or become intermittent, but a trouble code will be logged for future diagnosis.

**NOTE**: If the MIL is blinking during Key ON, Engine OFF situation, that means there is a stored diagnostic trouble code.

In any case, the operator must obtain service by an authorized PCM Premier dealer to determine the exact cause of the malfunction.

**NOTICE:** Some boat builders may install their own alarm system. It is recommended that the boat owner check with his or her boat dealer for an explanation of the particular alarm system upon initial delivery.


***Figure 5-1*** Typical Warning Lamp Cluster - CES Engines

## INSTRUMENTATION

Boat manufacturers install many different types of instrumentation on boats. Become familiar with the instrumentation on your boat and be aware of abnormal operating conditions. The following is a brief explanation of typical instrumentation found on most boats:

1. Tachometer - indicates the engine RPM (revolutions per minute)
2. Water Temperature Gauge - indicates the engine coolant temperature
3. Oil Pressure Gauge - indicates the engine oil pressure
4. Voltmeter - indicates the battery voltage and charging system voltage
5. Hour Meter - indicates the engine operating time
6. Fuel Level Gauge - indicates the fuel tank level
7. Check Engine Lamp - indicates a problem with the engine control system

## STARTING ENGINE (FUEL INJECTED ENGINES)

**IMPORTANT: The following items should be checked before starting the engine, and each time the boat is operated:**

- Fuel system for any signs of leakage
- Operation of remote controls and steering
- Engine and transmission oil levels
- Fuel tank levels
- Exhaust system for leaks and tightness of the clamps
- Battery connections and water level in battery cells
- Accessory drive belt(s)
- Cooling system for leaks. Check coolant level. Check for signs of coolant leaks. If the water is leaking externally, it is possible that the water is also leaking internally. This could result in internal engine damage. It is very important to service these maintenance items as soon as a problem is indicated.

After performing the initial safety checks, proceed as follows to start the engine:

1. Turn the battery switch ON (if equipped).
2. Open the fuel valve.
3. Do not pump or open the throttle when starting the engine. The ECM will automatically regulate the fuel and control desired idle speed.
4. Turn the ignition key to the start position. When the engine starts, release the key.

**NOTICE:** Engine idle speed is controlled by the ECM and is based on the operating temperature of the engine. Upon initial start-up, engine RPM will be slightly higher and will automatically decrease as the engine operating temperature increases.

5. **In the event the engine becomes flooded,** move the throttle lever to a 100% open position. At this throttle position, the ECM will command the injectors to deliver no fuel during engine cranking. When the engine starts, return the throttle back to the idle position.

**IMPORTANT: If the engine fails to start within 20-30 seconds, turn the ignition key to the OFF position and allow 2 minutes for the starter motor to cool off before attempting to restart the engine.**

**NOTICE:** If engine still fails to start, contact your PCM Engine Dealer for service.

6. Check engine oil pressure immediately after the engine starts. If oil pressure is not within specifications (see Engine Specifications), immediately stop the engine and determine the cause.
7. Check voltmeter for proper charging system operation.
8. Check the engine and gear box for fuel, oil, and coolant leaks.
9. Allow the engine to reach normal operating temperature. Check the temperature gauge to ensure the engine is operating within the normal temperature range. If the temperature is abnormally high, stop the engine immediately and determine the cause.

## STOPPING ENGINE

When returning to the dock, or whenever stopping the engine, bring the throttle back to the idle position. After the engine reaches idle speed, turn the ignition key to the OFF position.

Before stopping the engine after extended high speed operation, allow the engine to idle at 1200 RPM for 3 to 5 minutes to allow the engine to cool down before shutting off the ignition.

After stopping the engine, complete the following:

1. Turn the battery switch OFF, if equipped.
2. Close the fuel valve.

## PROPELLER SELECTION

Best all-around performance and maximum engine life is achieved when the engine is propped to run near the top of (but within) the recommended full throttle RPM range with a normal load. See ENGINE SPECIFICATIONS for rated full throttle RPM for your model engine.

Generally, gross weight (total weight of the entire boat, including full fuel and water, optional equipment, passengers and other miscellaneous gear) is one of the major factors and should be one of the primary considerations when selecting a propeller. Other factors to take into consideration are as follows:

- Warmer weather and higher humidity will cause an RPM loss.
- Operating the boat in a higher elevation will cause an RPM loss.
- Operating the boat with an increased load will cause an RPM loss (additional equipment, passengers, etc.).

If full throttle RPM is above or below the recommended range as stated in ENGINE SPECIFICATIONS, the propeller must be changed to prevent loss of performance.

### ENGINE RPM CHART

| Model | Minimum Full Load | Preferred | Maximum |
|---|---|---|---|
| **6.0L (HO)** | 5400 | 5600 | 5800 |
| **6.2L (SC)** | 5200 | 5300 | 5400 |

**CAUTION**

Prolonged WOT operation will shorten the life of your engine and could cause premature engine failure. See NORMAL CRUISING SPEEDS in SPECIFICATIONS. Problems caused by WOT operation are considered abuse and are not covered under the PCM Warranty.

**NOTICE:** These engines incorporate an RPM “REV LIMIT” in order to prevent the engine from over-revving.

**WARNING**

Use this procedure ONLY when conditions are such that it can be done in complete safety.

The break-in period of your engine is the first 25 hours of operation. Proper engine break-in is essential to achieve maximum performance, longevity and minimum oil consumption. During the break-in period, the following operation guidelines must be adhered to:

- After the engine is thoroughly warmed up, and the boat is underway, open the throttle to wide open throttle until maximum RPM is reached. DO NOT EXCEED MAXIMUM RPM. (RPM should cease climbing after 10 to 20 seconds).

**CAUTION**

DO NOT operate at full throttle in neutral at any time, or at sustained full throttle during the first 5 hours of operation. Thereafter, use sustained wide open throttle in the event of an emergency.

- Reduce the throttle to 2800 - 3000 RPM, and cruise at or below this speed for 1/2 hour. Reduce the speed to idle. Go to wide open throttle until maximum RPM is reached and operate for approximately 1 minute. Reduce throttle to 2800-3000 RPM and operate for a few minutes. (Bringing the engine speed from idle to wide open throttle will load the engine and assist in seating the piston rings). This cycle can be repeated from time to time during the first 5 hours of operation, but wide open throttle should not be sustained for more than 1 minute.

- During the early part of the break in period, the correct propeller selection can be confirmed. (With a normal load aboard, the engine's RPM should reach, but not exceed, the maximum RPM as listed in the specifications section).

- During the break in, all gauges should be watched carefully, and the speed should be reduced if abnormal readings become evident.

**CAUTION**

DO NOT attempt to break in any engine by prolong idling, or running at the dock.

The engine oil level should be checked often and oil added when necessary. It must be understood that every internal combustion engine will use a certain amount of oil during operation to act as a lubricating and cooling agent, especially during the break-in period. Oil consumption should decrease and become stabilized after approximately 100 hours of operation.

At the end of your 25-hour break-in period, contact your dealer and have the recommended 25-hour inspection done.

**NOTICE:** PCM Engines assumes no responsibility for the costs related to the 25-hour inspection. This is the owner's responsibility.

# 25-HOUR ENGINE INSPECTION - 8

After the first 25 hours of operation, it is recommended that the engine be given an inspection. Your boat dealer or a PCM servicing dealer should be contacted to perform the necessary checks and adjustments to ensure the proper engine performance. The following maintenance should be performed:

- Change the engine oil and filter.
- Replace the primary fuel filter
- Check the engine alignment.
- Inspect the accessory drive belt(s) and check the tension.
- Check all the fluid levels.
- Check the throttle cable adjustments and check for freedom of movement.
- Cooling System - Inspect all the hoses for leaks, damage and deterioration. Check all the hose clamps for adequate tightness.
- Exhaust System - Inspect the entire exhaust system for leaks, damage and deterioration.
- Battery - Check the electrolyte level and specific gravity. Inspect the case for damage. Check the battery cables and connections.
- Engine Assembly - Check for loose, missing or damaged parts. Pay close attention to engine mounts, starter and alternator mounting fasteners.

**NOTICE:** PCM Engines assumes no responsibility for the costs related to the 25-hour inspection. This is the owner's responsibility.

## GASOLINE REQUIREMENTS

**CAUTION**

**Fire and Explosion Hazard** - Gasoline is extremely flammable and highly explosive, and , if ignited, can cause serious bodily injury or death. Careful inspection of the entire fuel system including, but not limited to, fuel tanks, fuel lines, fuel filters and all fittings is mandatory, especially after periods of storage. Replace any component that shows signs of leakage, corrosion, deterioration, swelling, hardening or softening.

***WARRANTY NOTICE:*** Damage caused to the engine through the use of improper gasoline, low-quality or gasoline with an octane rating below the minimum requirements listed below, is considered misuse of the engine. Such damage is not covered by the PCM Marine Engines warranty.

The ignition timing set by the factory requires the use of a high-quality lead-free regular gasoline with the following minimum octane specification.

Pump Octane Number (R+M/2) (PUMP) - 93

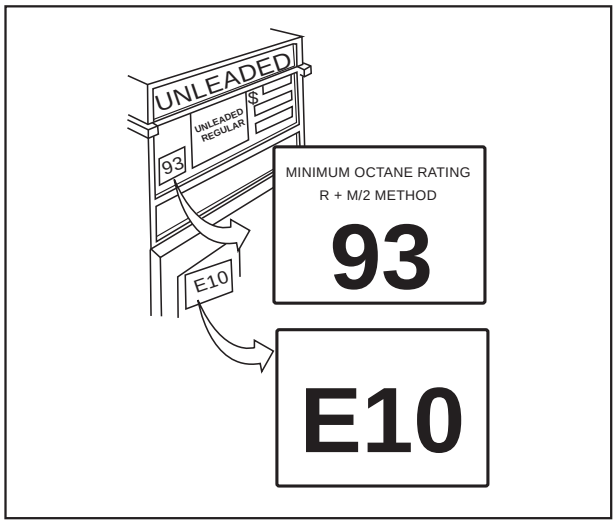



***Figure 9-1*** Fuel Requirements

***WARNING: The 6.0L HO and 6.2L Supercharged applications REQUIRE the use of premium 93 Octane fuel. Failure to due so could result in poor engine performance and engine damage that is not covered under warranty.***

## GASOLINE CONTAINING ALCOHOL

The implementation of ethanol-based fuel is spreading rapidly throughout the United States. As such, PCM Engines provides the following information regarding the use of this fuel.

This information addresses the use of ethanol fuels in PCM ENGINES ONLY. It does not address the use of ethanol fuels in vessel related components such as boat gas tanks, boat fuel lines, etc.

***Ethanol blended fuel rated E10 or less is acceptable to use. Fuels rated higher than E10 SHOULD NOT BE USED. Ethanol fuels rated higher than E10 could potentially damage the engine and/or present an unsafe boating condition. Damage to the engine resulting from the use of ethanol fuel rated higher than E10 IS NOT covered by the warranty.***

**CAUTION**

**Do Not use any gasoline that contains METHANOL. This fuel is very corrosive and will create unsafe operating conditions. Serious damage will result from the continued use of fuel containing METHANOL. Any resulting engine damage will not be covered by the warranty.**

If ethanol blended fuel rated E10 or less is used, or if the presence of alcohol is uncertain, more frequent inspections and service of the complete fuel system are required. Any sign of fuel leakage or deterioration must be repaired immediately before further engine operation.

It is important to note that ethanol blended fuel will act as a solvent and will attract and hold moisture. ***Without proper fuel stabilization and fuel filtration, ethanol blended fuel may cause the following:***

- Excessive moisture (water) may cause lean operation to include hard starting and operating difficulties such as, vapor lock, low speed stalling, and shortened fuel shelf life.
- Acting as a solvent, ethanol blended fuel may cause gum, sediment, sludge, and other particles to be loosened and carried through the fuel system to the engine.

**Fuel system or engine damage caused by contamination from water, foreign particles, sludge, or gums entering or forming in the fuel system is not covered by the PCM Limited Warranty.**

### Fuel Stabilizer Recommendations for Ethanol Blend Fuel

The use of a commercially available fuel stabilizer, such as **STA-BIL®**, is recommended at each fill-up or when storing ethanol-blended fuel for more than **2 weeks**.

# OIL REQUIREMENTS - 10

## ENGINE OIL RECOMMENDATIONS

### Use of Supplemental Additives

Engine oils meeting PCM Engines' recommendations already contain a balanced additive treatment. The use of supplemental additives which are added to the engine oil by the customer are unnecessary and may be harmful. PCM Engines does not review, approve or recommend such products.

### Synthetic Oils

Synthetic engine oils may be used in PCM Marine Engines. Synthetic oils must meet the Engine Oil Requirements for Classification and Viscosity listed below. The use of synthetic oil **does not** permit the extension of oil change intervals.

### Engine Oil Requirements (6.0L HO)

The following chart shows the recommended oil viscosity for various ambient temperature ranges:

| Prevailing Ambient Temperature | Recommended A.P.I. Classification & Viscosity |
|---|---|
| Above 50˚F | SAE 15W-40 "GF-4/SM" |
| Below 50˚F | SAE 5W-30 "GF-4/SM" |

### Engine Oil Requirements (6.2L Supercharged)

| Prevailing Ambient Temperature | Recommended A.P.I. Classification & Viscosity |
|---|---|
| All Temperatures | Mobil 1 Synthetic 5W-30 |

**IMPORTANT: The use of oils which contain "solid" additives, non-detergent oils or low quality oils specifically are not recommended.**

***WARRANTY NOTICE:*** PCM Engines reserves the right to refuse warranty on part(s) and/or engine(s) damaged by using improper fuels and engine oils.

### Oil Change Intervals (Common)

Crankcase oil and oil filter change - Recommended intervals:

- Initial oil change - 1st 60 days or 25 hours of operation, whichever occurs first
- Regular oil changes - Every 50 hours of operation or 120 days, whichever occurs first

## ENGINE MAINTENANCE

Refer to the MAINTENANCE SCHEDULE for a complete listing of required maintenance and the frequency at which it should be performed. While some procedures may be performed by the owner/operator, PCM Engines strongly recommends that all engine service and maintenance be performed by an authorized PCM Engines Premier Dealer. Before performing any maintenance or repair procedure not covered in this manual, it is strongly recommended that a PCM Engines repair manual be purchased and read thoroughly.

## CHECKING FLUID LEVELS

### Engine Crankcase Oil

**CAUTION**

**Do Not overfill engine crankcase with oil. Excessive oil can lead to premature engine component failure and/or loss of performance.**

**IMPORTANT:** ***The engine oil level must be checked while the boat is in its normal, level, at rest position on the water. Excessive wave action side to side or fore and aft may cause you to obtain erroneous readings. If the oil level is being checked while the boat is on a trailer, ensure the trailer is on level ground, then adjust the trailer so the boat is at its normal, at rest position. Excess water in the bilge and, if equipped, ballast systems must be purged when checking the engine oil level, otherwise erroneous readings may be obtained.***

1. **Stop** the engine, if running. Allow approximately 5 minutes for the oil to drain back into the oil pan.
2. Remove the dipstick, wipe it clean, and reinstall it until it is within two (2") inches of being fully seated. Slowly move the dipstick up and down approximately one-half (1/2") several times; then fully seat the dipstick into the dipstick tube.
3. In order to obtain an accurate reading, wait two minutes for the oil to stabilize on the dipstick. Remove the dipstick and observe the oil level. The oil level must be between the "FULL" and "ADD" marks. If the oil level is below the "ADD" mark, add specified oil to bring the level up to, but not over, the "FULL" mark on the dipstick. If the oil level is above the "FULL" mark on the dipstick, remove the excess oil. (Figure 11-1)

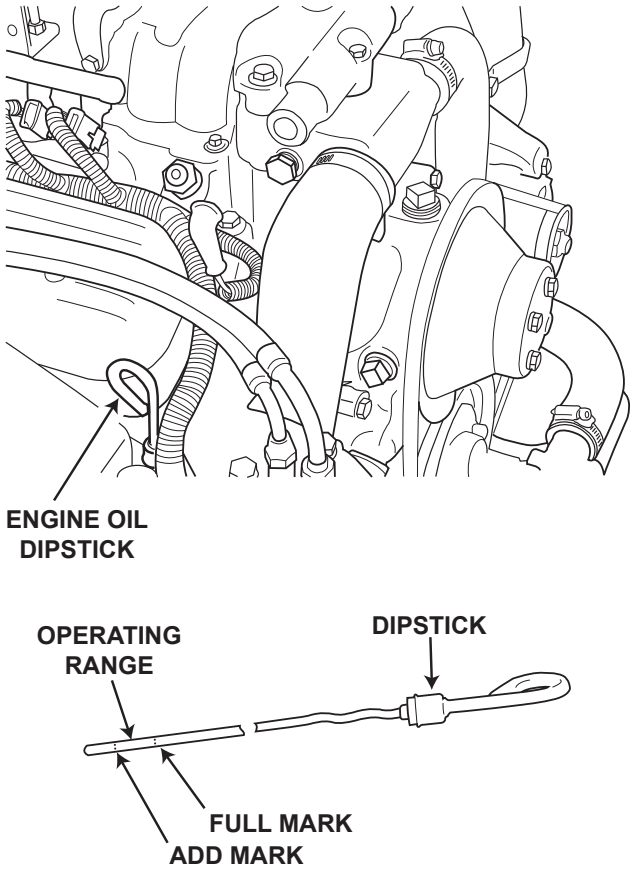



***Figure 11-1*** Engine Oil Dipstick (Typical)

**WARNING**

The machinery space must be closed anytime the engine is running to prevent injury to you or others on board. Never operate the engine with the engine machinery space open while someone is in the machinery space, either closed or open. Never open the machinery space unless the engine is shut off and the engines rotating parts are stationary. Rotating machinery can cause injury and even death if an accident should occur. Extreme care must be exercised if a problem exists that requires operation of the engine with the machinery space open. ***IT IS RECOMMENDED THAT UNCOVERED ENGINE OPERATION BE ATTEMPTED BY TRAINED AND QUALIFIED SERVICE PERSONNEL ONLY.***

## LUBRICATION

### Throttle Cable

Lubricate pivot points and exposed cable (Figure 11-2) with SAE 30W-30 engine oil.

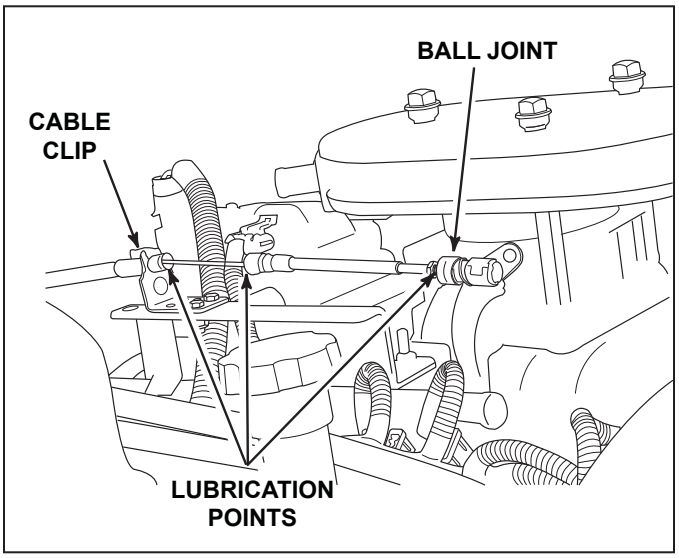



***Figure 11-2*** Typical Throttle Cable

## ELECTRICAL SYSTEM RELAY AND FUSE BLOCK

### MAIN PANEL FUSE

PCM engines are equipped with a 40 Amp PANEL fuse which provides electrical overload protection for the boat's instrumentation wiring and components. Should an electrical overload occur, the PANEL fuse will open and prevent electrical current flow.

When this fuse opens, the cause for the high current draw must be found and corrected. Check the battery and alternator connections and all other harness connectors between the boat and the engine main harness. Check for loose or disconnected lead wires and shorted circuits. Replace the PANEL fuse and resume operation. If the cause of the overload cannot be found, consult an authorized PCM Engines dealer to make necessary repairs.

### ELECTRICAL SYSTEM FUSES

PCM engines utilize fuses to protect critical engine components and devices. The fuel pump, ECM, ignition components, fuel injectors, starter and diagnostic devices are protected by fuses. The fuse block is mounted on a bracket near the rear of the engine.

### BOAT'S IGNITION FUSE

If the engine will not crank when the ignition key is turned to the START position, first check that the shift lever is in the neutral position and the safety lanyard (if equipped) is attached properly. If none of the Fuse Block fuses are open, check for a blown boat ignition fuse. The boat's ignition fuse may be located on the instrument panel, the fuse holder block or as part of the helm's instrument wiring harness. Check the wiring diagrams supplied from the boat manufacturer for the exact location.

**WARNING**

Always disconnect the battery cables from the battery, when servicing the electrical system, to prevent personal injury and to prevent damage to the electrical system components.

## ELECTRICAL SYSTEM WIRING AND CONNECTORS

The electrical system wiring and connectors should be checked periodically for loose or dirty connections and damaged wiring. If electrical components or wiring show signs of corrosion, deterioration or damage, consult an authorized PCM Engines dealer to make necessary repairs.

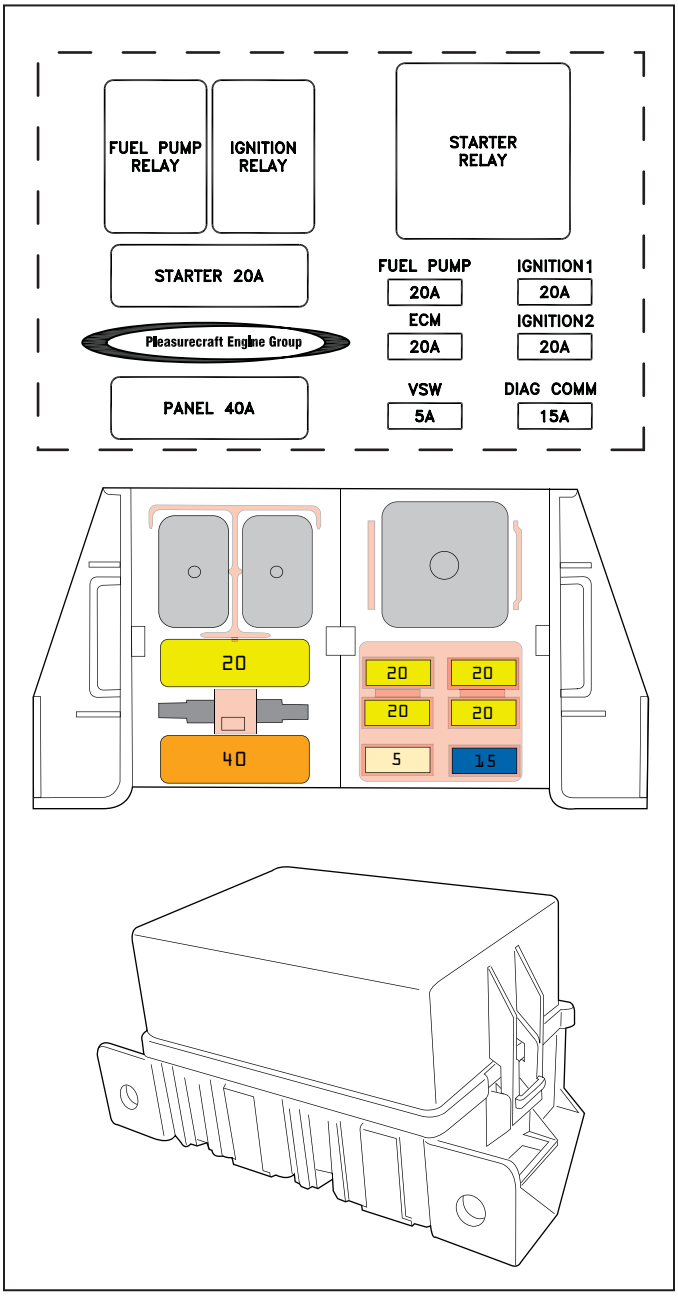



***Figure 11-3 (Typical)*** Electrical System Relay and Fuse Block

## BATTERY

**WARNING**

Battery electrolyte is a corrosive acid and should be handled with care. If electrolyte is spilled or splashed on any part of the body, IMMEDIATELY flush the exposed area with liberal amounts of water and obtain medical aid as soon as possible. Safety glasses and rubber gloves are recommended when handling batteries or filling with electrolyte.

**WARNING**

Hydrogen gases that escape from the battery when charging are highly explosive. Do not use jumper cables and a booster battery to start the engine. Do not recharge a weak battery in the boat. Remove the battery from the boat and recharge in a well ventilated area away from fuel vapors, sparks and open flames.

Follow maintenance instructions and warnings as supplied by the battery manufacturer. If this information is not available, follow these guidelines for the proper battery care.

- Do not operate the engine with an open in the battery circuit, as this may cause damage to the alternator. Make sure that all connections are clean and secure.
- When removing the battery cables, always remove negative (-) cable first, and then remove the positive (+) cable. When installing battery cables, install the positive (+) cable first, then install the negative (-) cable.
- Periodically check the battery for signs of corrosion, frayed battery leads or cracked case. Repair or replace as necessary.
- Periodically check the electrolyte level. Add distilled water to bring up to the proper levels.

## TESTING COOLANT FOR ALKALINITY

It is recommended that the coolant in the fresh-water section be tested each year for alkalinity. Coolant that is not alkaline has lost the effectiveness of its rust inhibitors, which can lead to internal corrosion and cooling system problems. It is recommended to replace the standard ethylene glycol coolant in the system every two years to prevent a build-up of harmful chemicals within the fresh-water system.

**WARNING**

Do not remove cooling system filler cap when the engine is hot. Allow the engine to cool and then remove the pressure cap slowly, allowing the pressure to vent. Hot coolant, under pressure, may discharge violently and cause severe burns.

1. Obtain red litmus paper from a local supplier (drugstore, laboratory, etc.).
2. Remove the pressure cap from the coolant filler neck and insert one end of the litmus paper into the coolant.
3. If red litmus paper turns blue, coolant is alkaline and does not need to be replaced. If the litmus paper remains red, the coolant is not alkaline and must be replaced.

**WARNING**

Do not remove cooling system filler cap when the engine is hot. Allow the engine to cool and then remove the pressure cap slowly, allowing the pressure to vent. Hot coolant, under pressure, may discharge violently and cause severe burns.

## DRAINING FRESH-WATER COOLING SYSTEM

**NOTICE:** To protect the environment, dispose of coolant properly. Check your local restrictions for proper disposal instructions of removed coolant.

**NOTICE:** Refer to cooling system water flow diagrams for drain locations.

1. Remove the following drain plugs to drain coolant from the fresh-water cooling system:
   - Remove the large hose from the engine block water circulating pump, or drain plug on circulation pump
   - Drain plugs on the cylinder block (one on each side)
2. After system has drained completely, coat all the drain plugs with PerfectSeal (or equivalent) and reinstall in the proper locations. Reinstall the hose(s) on the water circulating pump and tighten the clamps securely.

## FILLING FRESH-WATER COOLING SYSTEM

A new extended life engine coolant known as DEX-COOL™ is recommended for use in your engine. It is imperative to note the following about DEX-COOL™ engine coolant:

- IT IS PINK IN COLOR TO DISTINGUISH IT FROM CONVENTIONAL COOLANT.
- THE SERVICE CHANGE INTERVAL ON ENGINES BUILT WITH DEX-COOL™ IS 5 YEARS.
- TO MAINTAIN FULL CORROSION PROTECTION DURABILITY, DEX-COOL™ MUST NOT BE MIXED WITH CONVENTIONAL (CONTAINING SILICATE) ENGINE COOLANTS.
- DEX-COOL™ IS AN ETHYLENE GLYCOL BASED PRODUCT, THEREFORE, BOIL AND FREEZE PROTECTION ARE MEASURED IN THE SAME FASHION AS CONVENTIONAL COOLANTS.

TO FULLY REALIZE ITS MANY ADVANTAGES, DEX-COOL™ MUST NEVER BE MIXED WITH CONVENTIONAL COOLANTS.

DEX-COOL™ can become contaminated by inadvertently topping-off with conventional coolant, adding conventional coolant to the system or even if fill/drain containers are shared between coolants. If contamination occurs, the cooling system must be immediately drained and flushed, and refilled with DEX-COOL™. No short-term damage will occur, however, the service interval will be reduced from 5 years to 2 years.

The fresh-water cooling side of the cooling system must be filled with a 50/50 mixture of DEX-COOL™ (or equivalent, which meets GM6277M) extended life antifreeze and water solution.

**IMPORTANT: More than 50% antifreeze solution can contribute to an overheating condition.**

1. Make sure that all drain plugs are properly installed.
2. Remove the pressure cap. Fill the system with antifreeze solution until the system is filled. See ENGINE FLUID CAPACITIES for system capacities.
3. Start the engine and operate at idle speed (800-1000 RPM) to purge any air from the system. When the system is full, install the pressure cap.

## FUEL SYSTEM DESCRIPTION

**WARNING**

Extreme caution must be exercised when servicing the fuel system and/or replacing fuel filter. Gasoline is extremely flammable and highly explosive under certain conditions. Be sure the ignition key is off and do not smoke or allow open flame in the area while servicing. Wipe up any spilled fuel immediately.

**WARNING**

Extreme caution must be exercised when servicing the fuel system. The fuel system operates under high pressure. Use caution when removing or replacing components, as residual pressure may be present.

**WARNING**

Make sure that there are no fuel leaks before closing the engine hatch.

**WARNING**

Visually inspect unit for fuel leaks before operating the engine. If fuel leaks are present, DO NOT operate the engine, contact your service center immediately.

### Fuel Control Cell (FCC) Fuel System

The Fuel Control Cell (FCC) eliminates vapor lock and air ingestion caused by fuel tank slosh, and provides the necessary filtration and water separation.

The FCC system incorporates two (2) fuel pumps to provide an uninterrupted flow of fuel to your PCM marine engine. Fuel is fed into the FCC bowl by a low-pressure, high-volume electric fuel pump. This pump flows fuel at a volume much greater than the fuel flow rate required of the high-pressure pump and engine demands. The high-pressure pump, mounted inside the FCC bowl, provides the necessary fuel pressure and volume to maintain proper engine performance. The FCC constantly has an ample supply of fuel to meet the idle, cruise and acceleration fuel requirements of the engine.

The fuel pressure regulator, located on the fuel rail, controls the fuel pressure, and maintains a constant pressure across the fuel delivery system. Excess fuel, not used by the engine, returns to the FCC bowl.

The fuel delivered to the engine by the FCC is filtered by a filter and water separator element, which surrounds the high pressure pump inside the FCC bowl.

As indicated above, fuel enters the FCC bowl from two (2) locations, the low-pressure pump (initial input) and the fuel pressure regulator (unused, recirculating fuel). Fuel exits the FCC bowl at two (2) locations, the high-pressure output to the fuel injection system and all excess fuel in the FCC bowl is routed back to the tank via the return line.

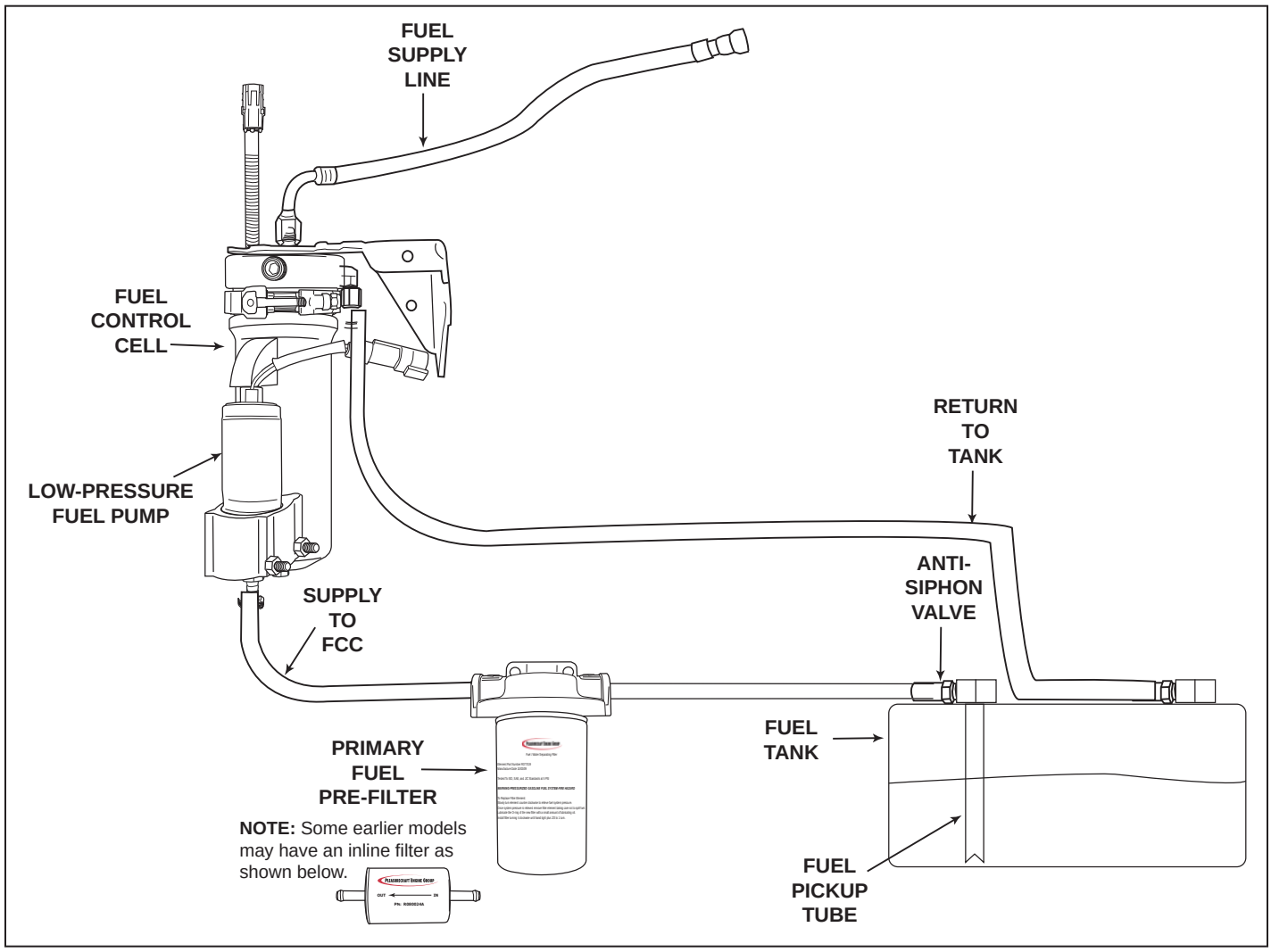



***Figure 11-5*** Fuel Control Cell (FCC) Fuel System (Typical)

## Servicing the FCC

The frequency of draining the water or replacing the filter element is determined by the contamination level of the fuel. Replace the filter element at least once a year, or when a loss of power is noticed (whichever occurs first).

**WARNING**

Improper use, installation or servicing may cause an explosion or fire resulting in bodily injury, or death. This unit should only be serviced by a qualified technician. Read and follow all instructions before proceeding. Run the engine and check for fuel leaks after installation, element replacement or draining the bowl. DO NOT remove the FCC bowl unless servicing the filter element, otherwise contamination or bowl O-ring swelling may result.

### Primary Fuel Filter (FCC Clamp-on Canister)

**WARNING**

Extreme caution must be exercised when servicing the fuel system. The fuel system operates under high pressure. Use caution when removing or replacing components, as residual pressure may be present.

### Draining the FCC Bowl, ENGINE OFF

1. Disconnect the two-wire electrical connectors from the FCC and the Low Pressure Fuel Pump (LPFP).
2. Remove the 7/16” plug, and drain the bowl contents into an approved container.

***CAUTION: Both fuel and water will drain from the FCC bowl.***

3. Apply pipe sealant, suitable for use with gasoline, to the threads of the 7/16” plug.

4. Tighten the 7/16” plug.
5. Reconnect the two-wire electrical connectors to the FCC and LPFP.
6. Cycle the ignition key several times to run the electric fuel pumps and fill the FCC bowl with fuel. Inspect the drain plug area for leaks. Correct any leaks prior to operating the engine.
7. Start the engine and inspect for fuel leaks. Correct any leaks prior to operating the engine any further.

### Filter Element Replacement, ENGINE OFF

**FCC SERVICE KIT#: RP080026**

1. Disconnect the two-wire electrical connectors from the FCC and the Low Pressure Fuel Pump (LPFP).
2. Disconnect the fuel supply line from the LPFP.

**WARNING**

***Residual fuel will leak from the pump and the supply line. Elevate and plug the supply line to minimize fuel leakage. Capture/clean-up spilled fuel as required. Dispose of shop towels in an approved container.***

3. Remove the 7/16” plug, and drain the bowl contents into an approved container.

***CAUTION: Both fuel and water will drain from the FCC bowl.***

4 Remove the canister retaining clamp.

5 Slide the canister downward over the suspended filter element. It may be necessary to pull the unit to one side in order to remove.

6. Remove the fuel filter element from the suspended pump by gripping the fuel pump with one hand, and pulling the filter element downward with the other hand.
7. Visually inspect all internal components, i.e. hoses, wires, etc.
8. Push on new filter element (part number RP080026) over the electric fuel pump.
9. Using a pick made of soft material, such as a toothpick, remove the old O-rings from the FCC head.

***CAUTION: The mounting head O-ring grooves may be damaged by using sharp steel tools to remove the O-rings.***

***CAUTION: Use only fuel approved O-rings (R047241) provided in RP080026 Kit. Use of non-approved O-rings may cause fuel to leak from the FCC.***

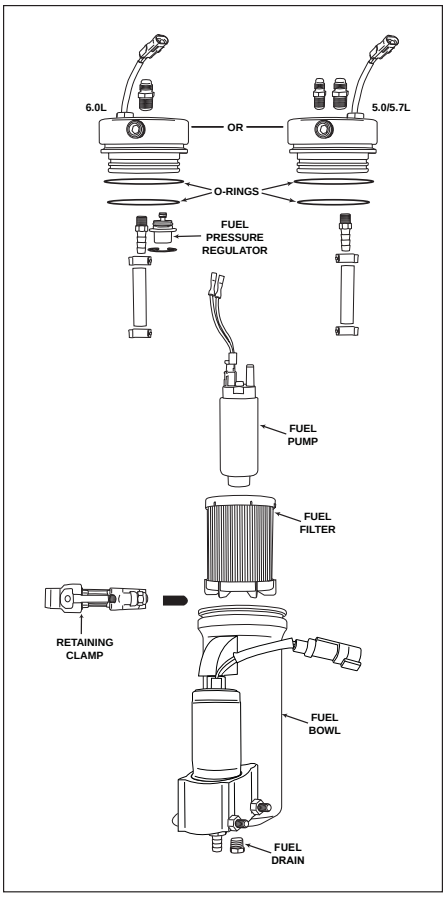



***Figure 11-6*** Fuel Control Cell (FCC) - Clamp-on Canister (Typical)

10. Install the new O-rings in the same location. Lubricate the new O-rings with a fuel resistant O-ring lubricant.
11. Apply pipe sealant, suitable for use with gasoline, to the threads of the 7/16” plug.
12. Install and tighten the 7/16” plug into the canister.
13. Install the canister firmly back onto the FCC head.
14. Reinstall the retaining clamp and tighten securely.
15. Reconnect the fuel supply line to the LPFP.
16. Reconnect the two-wire electrical connectors to the FCC and the LPFP.
17. Cycle the ignition key several times to run the electric fuel pumps and fill the FCC bowl with fuel. Inspect the drain plug area for leaks. Correct any leaks prior to operating the engine.
18. Start the engine and inspect for fuel leaks. Correct any leaks prior to operating the engine any further.

***DO NOT ATTEMPT TO SERVICE ANY OTHER PARTS ON THIS UNIT.***

## Servicing the Primary Fuel Filter

The frequency of replacing the filter element is determined by the contamination level of the fuel. Replace the filter element at least once a year, or when a loss of power is noticed (whichever occurs first).

**WARNING**

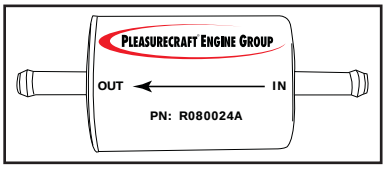
Improper use, installation or servicing may cause an explosion or fire resulting in bodily injury, or death. This unit should only be serviced by a qualified technician. Read and follow all instructions before proceeding. Run the engine and check for fuel leaks after installation or element replacement.

## Filter Element Replacement, ENGINE OFF

### PRIMARY FUEL PRE-FILTER #: R080024A (INLINE)

**NOTE:** This filter may be located in various locations. Consult your boat manufacturer's operation manual for correct location.

1. Disconnect the fuel lines from the input and output of the filter and block the lines to prevent fuel spillage.
2. Remove the filter.
3. Install the new filter. Ensure the new filter is installed correctly. Input side of the filter is from the fuel tank and output is to the engine.
4. Re-install the fuel lines and tighten the retaining clamps securely.
5. Start the engine and inspect for fuel leaks. Correct any leaks prior to operating the engine any further.

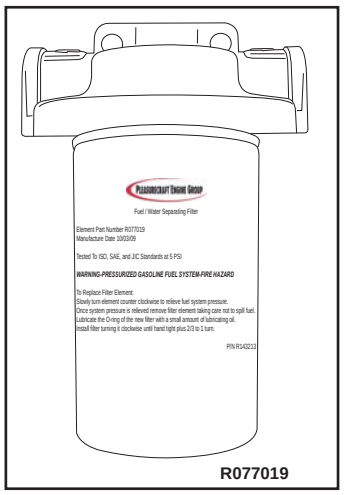



## Filter Element Replacement, ENGINE OFF

### PRIMARY FUEL PRE-FILTER #: R077019 (SPIN-ON)

**NOTE:** This filter may be located in various locations. Consult your boat manufacturer's operation manual for correct location.

1. Loosen the fuel filter by spinning it counterclockwise. A filter wrench may be required.
2. Remove the filter. Ensure that the old O-ring is removed with the filter.
3. Install the new filter by spinning it on clockwise.. Ensure the new filter is installed correctly. Tighten the filter securely.
4. Start the engine and inspect for fuel leaks. Correct any leaks prior to operating the engine any further.




## Priming Fuel System

To prime the fuel system, cycle the ignition key 3 times using the following procedures:

1. Turn ignition key to ON position for 5 seconds.
2. Turn ignition key OFF.
3. Pause for 10 seconds.
4. Repeat steps 1-3 three times.

Crank the engine until it starts or 30 seconds elapse. If the engine does not start, repeat the priming procedures.

**WARNING**

Make sure there are no fuel leaks before closing the engine hatch.

## FLAME ARRESTOR

At specified intervals, the flame arrestor should be checked for blockage caused by dirt or other foreign material.

Loosen the clamp securing the flame arrestor to the air intake tube or throttle body. Remove the flame arrestor. Clean the flame arrestor with solvent and dry with compressed air. Reinstall the flame arrestor and tighten the clamp(s) securely.

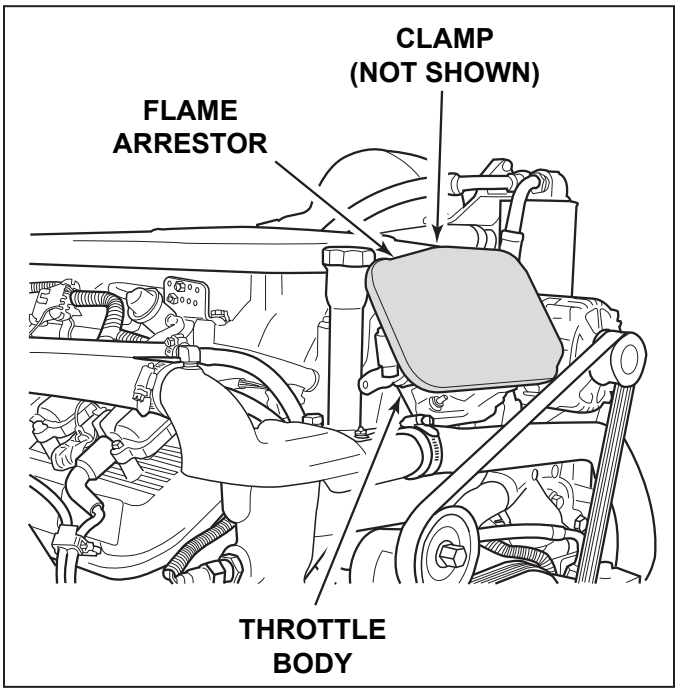



***Figure 11-7*** Flame Arrestor - (Typical)

## ACCESSORY DRIVE BELT

The PCM engine uses a single serpentine belt to drive the engine water circulation pump and the alternator.

**WARNING**

Engine must be shut OFF and the ignition key removed before inspecting the drive belt(s). The drive belt(s) should be checked periodically for condition and tension. If the belt(s) shows signs of cracking, glazing or deterioration, replace with new belt(s).

## DRIVE BELT INSPECTION

Inspect the drive belt for excessive wear, shredding or missing sections.

Inspect the drive belt for contamination from excessive dirt, oil, coolant or other substances that may effect the drive belt operation.

If a problem is found, replace the belt after inspecting the following items:

- All pulleys and tensioners for signs of misalignment
- All pulleys and tensioners for signs of rust or other damage
- Bent pulleys or tight bearings in the engine water circulation pump, and alternator

## DRIVE BELT REPLACEMENT

### 6.0L HO SERPENTINE BELT #: R066035

1. Note the routing of the belt before removing.
2. Using a 15 mm box wrench or socket, turn the belt tensioner to relieve the tension on the belt. Slide the belt off of the pulleys. ***Release the tensioner slowly to prevent the tensioner from snapping against its stop, and possibly causing damage to the tensioner.***
3. Slide the belt onto the pulleys using the same routing as noted prior to removal.
4. Compress the belt tensioner, and slide the belt over the tensioner pulley. Release the tension slowly to tension the belt.

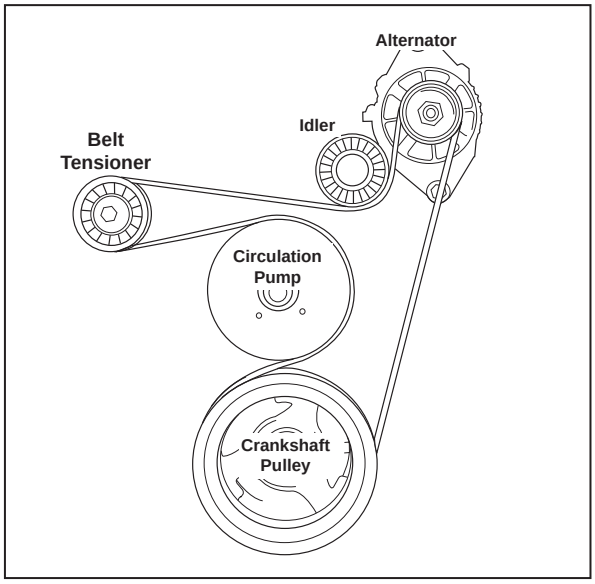



***Figure 11-8*** 6.0L Accessory Drive Belt Configuration

## DRIVE BELT REPLACEMENT

### 6.2L SERPENTINE BELT #: R066038

1. Note the routing of the belt before removing.
2. Using a 15 mm box wrench or socket, turn the belt tensioner to relieve the tension on the belt. Slide the belt off of the pulleys. ***Release the tensioner slowly to prevent the tensioner from snapping against its stop, and possibly causing damage to the tensioner.***
3. Slide the belt onto the pulleys using the same routing as noted prior to removal.
4. Compress the belt tensioner, and slide the belt over the tensioner pulley. Release the tension slowly to tension the belt.

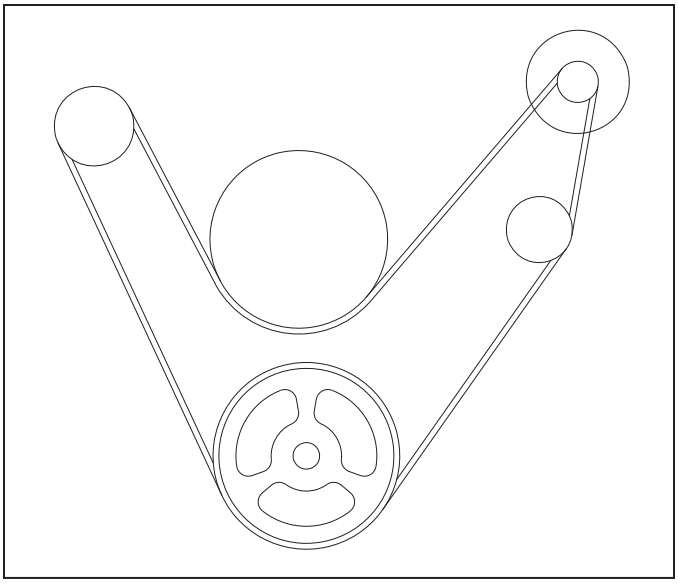


***Figure 11-8A*** 6.2L Accessory Drive Belt Configuration

## SUPERCHARGER BELT REPLACEMENT

### 6.2L SERPENTINE BELT #: R066037

1. Note the routing of the belt before removing.
2. Using a 1/2” drive ratchet, turn the belt tensioner to relieve the tension on the belt. Slide the belt off of the pulleys. ***Release the tensioner slowly to prevent the tensioner from snapping against its stop, and possibly causing damage to the tensioner.***
3. Slide the belt onto the pulleys using the same routing as noted prior to removal.
4. Compress the belt tensioner, and slide the belt over the tensioner pulley. Release the tension slowly to tension the belt.

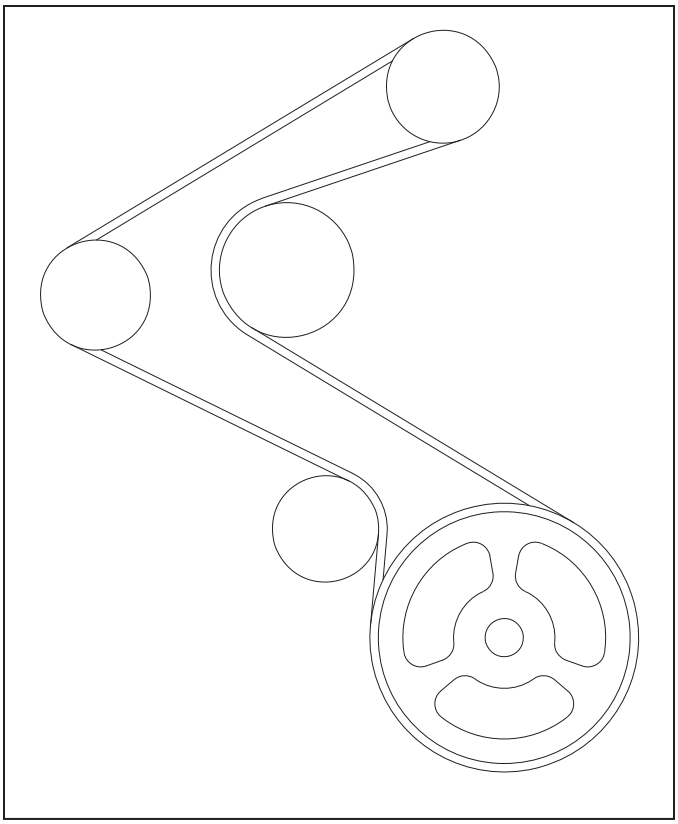


***Figure 11-8B*** 6.2L Supercharger Drive Belt Configuration

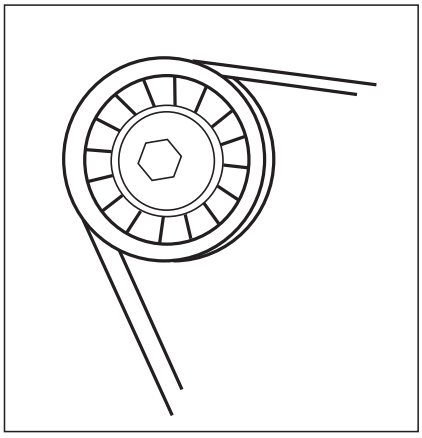


***Figure 11-9*** Belt Tensioner (6.0L/6.2L)

## CHANGING OILS

**WARNING**

IMPORTANT: The Federal Water Pollution Control Act prohibits the discharge of oil or oily waste into or upon the navigable waters and continuous zone of the United States, if such discharge causes a film or sheen upon, or discoloration of the surface of the water, or causes sludge or emulsion beneath the surface of the water. Violators are subject to a penalty of $5,000.00.

Refer to the MAINTENANCE SCHEDULE for oil change intervals. The engine oil should be changed prior to placing the boat into storage.

**IMPORTANT: Change the engine oil when the engine is warm from operation. Warm oil flows more freely, and allows more foreign material and impurities to be removed.**

1. With the engine at normal operating temperature, remove the oil pan drain plug ((1) side or bottom of pan) (Figure 11-14). Drain oil into a suitable container. Replace oil pan drain plug when crankcase is empty.

2. Remove the oil filter by turning it counterclockwise, using an oil filter wrench if necessary. Discard the old filter and sealing ring.

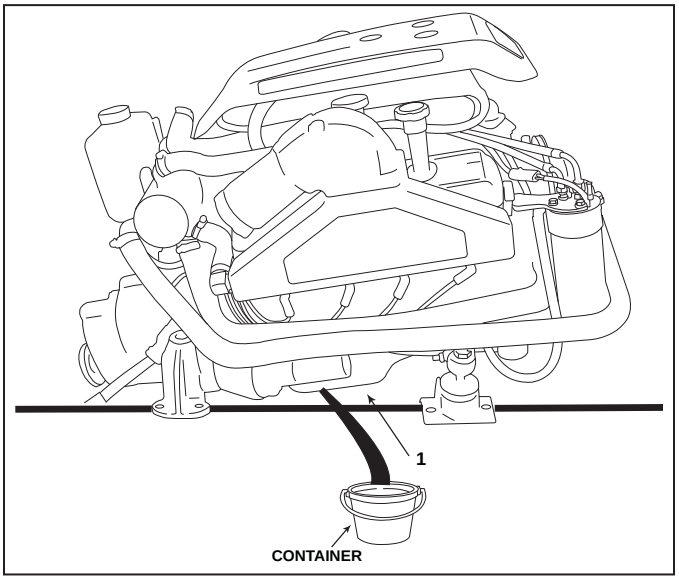



***Figure 11-14*** Engine Oil Removal (Typical)

3. Coat the sealing ring, on the new filter, with a light coating of clean engine oil. Install the oil filter securely by hand. DO NOT overtighten.

4. Fill the engine with the recommended oil, see OIL REQUIREMENTS, through the oil fill location on the valve cover (Figure 11-15).

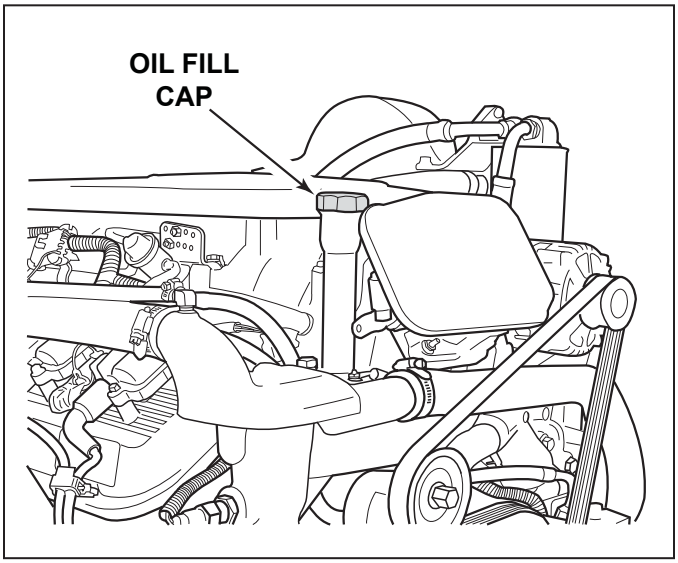



***Figure 11-15*** Engine Oil Fill

5. Start the engine and operate for 5 minutes to circulate the oil throughout the engine. Check entire system for leaks, especially around the oil filter.

6. Stop the engine and wait 5 minutes to allow the oil to completely drain down. Check the oil level and add oil, if needed, to bring the engine oil to the proper level.

| Date | ENGINE MAINTENANCE LOG<br>Maintenance/Repair | Operating Hours |
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# ENGINE MAINTENANCE - 11

## MAINTENANCE SCHEDULE

| Location and Service | Check Daily | After 1st 25 Hrs of Operation | Every 50 Hours of Operation | Every 100 Hours of Operation | Once Each Year |
|---|---|---|---|---|---|
| Check coolant level | X | | | | |
| Check oil level - Engine crankcase | X | | | | |
| Engine Assembly (complete - Check for obvious leaks (water, oil, fuel and exhaust) | X | | | | |
| Remote Control and Steering System - Check for proper operation | X | | | | |
| Cooling System - Check condition and tightness of all hose clamps | | X | | X[1] | X |
| Drive Belt - Inspect condition and check tension | | X | | X | X |
| Exhaust System - Check for leaks at the manifold | X | | | | |
| Ignition System and Spark Plugs - Clean and inspect condition | | O | | O | O |
| Engine Assembly (complete) - Check for loose, missing or damaged parts (especially engine mounts, starter and alternator mounting fasteners) | | X | | X | X |
| Change engine oil and filter | | X | X | | X |
| Engine Alignment - Check and adjust if necessary | | O | | | O |
| Ignition Timing - Not Adjustable | | | | | |
| Battery - Check electrolyte level and specific gravity. Inspect case for damage. Check cables and connections. | | X | X | | X |
| Electrical System (complete) - Check for loose or dirty connections and damaged wiring | | | X[2] | | X |
| Flame Arrestor and Crankcase Ventilation System - Clean and inspect | | | | X | X |
| Hoses (all) - Inspect for cracks, swelling, weather checking or other signs of deterioration | | | | X | X |
| Throttle Cable Linkage - Inspect and lubricate (A) | | | | X[1] | X |
| Fuel Filters - Service or replace | | O | O | | O |
| | | | | | |

**MAINTENANCE SCHEDULE (cont'd)**

| | |
|---|---|
| Fresh-water cooled models - Check coolant for alkalinity | At least once each year (X) |
| Fresh-water cooled models - Change coolant | Every two years (C) |
| Engine Assembly Exterior Surfaces - spray with rust-preventative oil (B) | Fresh water areas - Every 60 days (X)<br>Salt water areas - Every 30 days (X) |

**Notes:**

(X) Denotes service to be performed by the owner/ operator

(O) Denotes service to be performed by an authorized PCM Engines dealer

(A) Use SAE 30 engine oil

(B) Use WD-40 penetration oil or equivalent

(C) Every five (5) years when using DEX-COOL™

[1] In fresh-water areas, every 100 hours of operation or 120 days (whichever occurs first). In salt-water areas, every 50 hours of operation or 60 days (whichever occurs first).

[2] In fresh-water areas, every 50 hours of operation or 60 days (whichever occurs first). In salt-water areas, every 25 hours of operation or 30 days (whichever occurs first).

## VISUAL INSPECTION

It is important for the owner/operator to visually inspect the complete engine assembly at regular intervals. Most often, costly repairs can be avoided if potential problems are corrected before there is a failure.

Inspect the complete engine assembly for obvious fuel, oil, water or exhaust leaks. Check for loose, damaged or missing parts. Check all hose clamps for adequate tightness. Check the electrical system for loose or dirty connections or damaged wiring.

Touch up scratches, nicks and corrosion damage to the exterior finish of the engine. Spray paint may be obtained from your local PCM Engines dealer.

Protect engine finish from corrosion by periodically spraying the engine exterior finish with a rust preventative oil (such as WD-40).

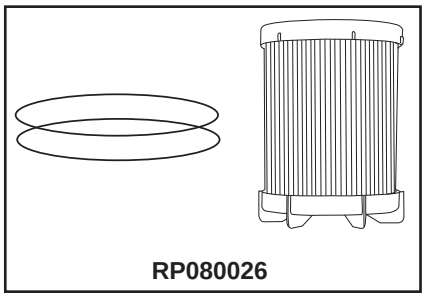
**ENGINE FLUID CAPACITIES**

| **Model** | **ALL MODELS** |
|---|---|
| Crankcase Oil Capacity **W / NEW FILTER** | Start with 4 Quarts (4.5 L)[1] |
| Fresh Water Cooling System Capacity | Fill Until Completely Purged[3] |

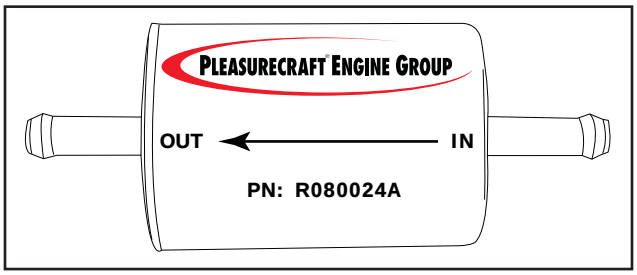
1 - Capacities are dependent on installation angle. Oil capacities are approximate. **Always use the dipstick to determine the exact quantity of oil required**.

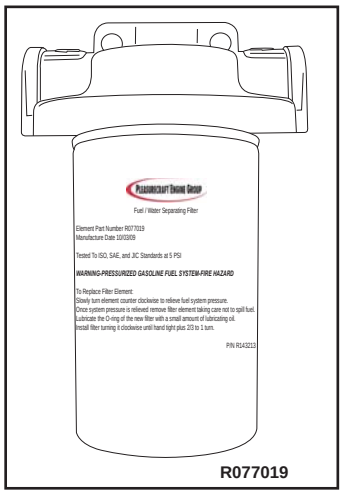
## FILTER REQUIREMENTS

| Description | Part No. |
|---|---|
| Oil Filter, 6.0L and 6.2L | PF46 |
| Fuel Control Cell (FCC) Fuel Filter Element | RP080026 |
| Primary Fuel Pre-Filter | R077019 |
| Primary Fuel Pre-Filter | R080024A |



RP080026




R077019

**ENGINE SPECIFICATIONS**

| MODEL | MP 6.0L (HO) | MP 6.2L (Supercharged) |
|---|---|---|
| **Displacement** | 6.0L (364 CID) | 6.2L (376 CID) |
| **Bore** | 4.0007 in. (101.618 mm) | 4.0649 in. (103.25 mm) |
| **Stroke** | 3.622 in. (92.0 mm) | 3.622 in. (92.0 mm) |
| **Compression Ratio** | 9.67:1 | 9.1:1 |
| **Compression Pressure** | 130 - 215 psi | 130 - 215 psi |
| **WOT Operating RPM0**<br>**Preferred WOT RPM** | 5200 - 5600<br>5500 | 5200 - 5400<br>5300 |
| **Cruising RPM (Max)** | 4200 | 4000 |
| **Idle RPM (In Gear)** | 650 (Not Adjustable) | 650 (Not Adjustable) |
| **Oil Pressure @**<br>**2000 RPM** | 25 - 80 psi<br>(172 - 552 kPa) | 25 - 80 psi<br>(172 - 552 kPa) |
| **Minimum Oil Pressure** | 6 psi (41.3 kPa<br>at Idle | 6 psi (41.3 kPa))<br>at Idle |
| **Spark Plug P/N**<br>**Spark Plug Gap** | R030011<br>0.040 in | R030012<br>0.040 in.. |
| **Firing Order** | 1-8-7-2-6-5-4-3 (LH) | 1-8-7-2-6-5-4-3 (LH) |
| **Thermostat** | FWC 195˚F (61.7˚C) | FWC 195˚F (61.7˚C) |
| **Over- Temperature** | 220° F (104.8° C) | 220° F (104.8° C) |
| **Electrical System** | 12 Volt Negative (-)<br>Ground | 12 Volt Negative (-)<br>Ground |
| **Alternator Rating** | 100 Amps | 100 Amps |
| **Ignition Timing** | Not Adjustable | Not Adjustable |
| **CAM Retard** | Not Adjustable | Not Adjustable |
| **Battery Rating** | 650 CCA (Minimum)<br>120 Ah | 650 CCA (Minimum)<br>120 Ah |
| **Fuel Pressure**<br>**STD. FCC** | 57-62 psi @ WOT | 57-62 psi @ WOT |

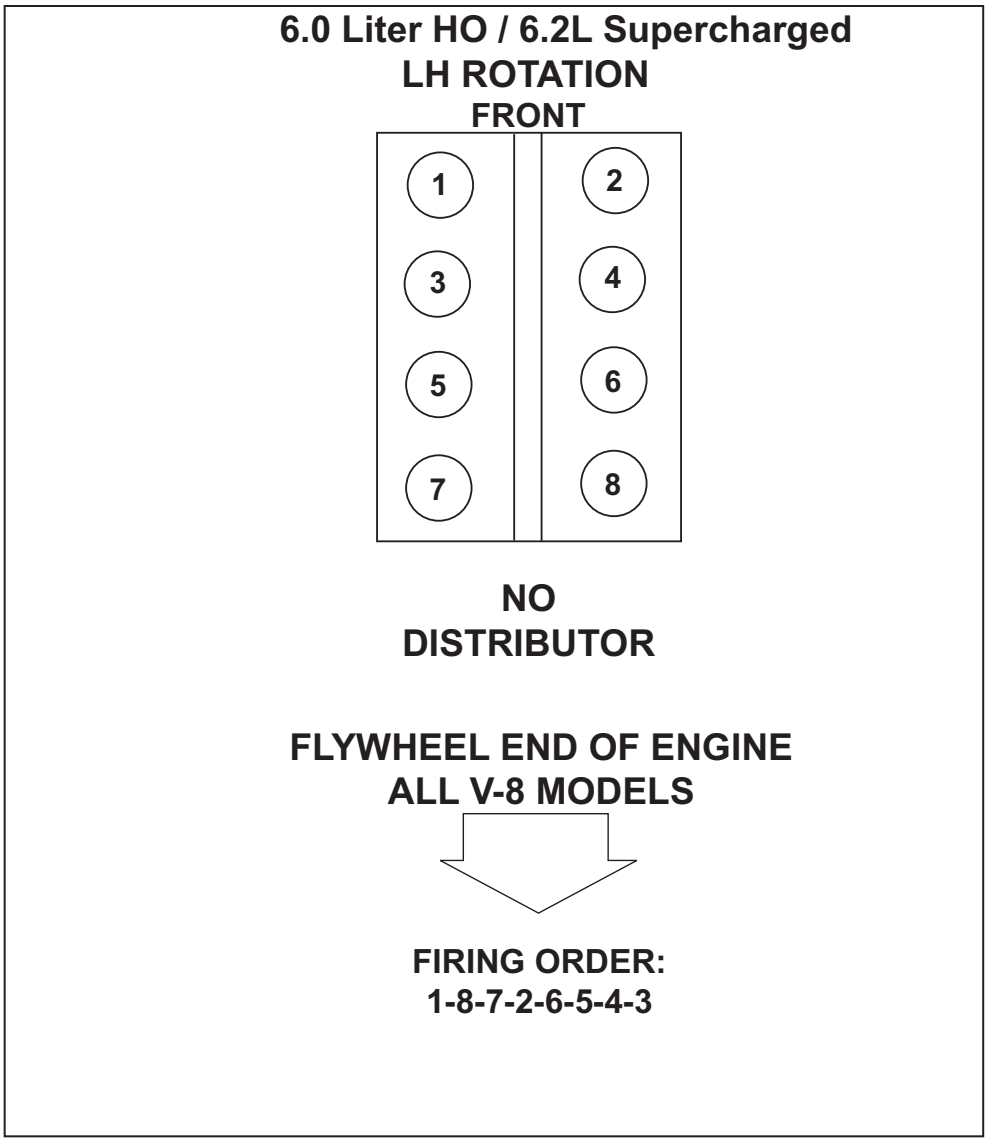



***Figure 12-1*** Firing Order

**TUNE-UP SPECIFICATIONS**

| Model | MP 6.0L HO | MP 6.2L SC |
|---|---|---|
| Spark Plug Type | R030011 | R030011 |
| Spark Plug Gap | 0.040 in.<br>(1.02 mm) | 0.040 in.<br>(1.02 mm) |
| Ignition Timing | Fixed,<br>Not Adjustable | Fixed,<br>Not Adjustable |
| Firing Order | 1-8-7-2-6-5-4-3<br>(LH Rotation) | 1-8-7-2-6-5-4-3<br>(LH Rotation) |
| CAM Retard | Not Adjustable | Not Adjustable |

## ENGINE STORAGE

**IMPORTANT:** This service should be performed by an Authorized PCM Dealer.

| CAUTION |
| --- |
| **Refer to FLUSHING COOLING SYSTEM before proceeding.** |

1. Fill the fuel tanks with gasoline (that does not contain alcohol) and add a sufficient amount of gasoline stabilizer, such as STA-BIL™ fuel stabilizer, to prevent the formation of fuel gum and varnish. Follow the instructions on the container.

**IMPORTANT:** If the boat is to be place into storage with fuel containing alcohol in the fuel tanks, the engine fuel system must be run dry at idle RPM. Fuel tanks should be drained completely and fuel conditioner, such as STA-BIL™, added to any fuel remaining in the tanks.

2. Run the engine and allow it to reach normal operating temperature. Shut down the engine and change the oil and oil filter (See ENGINE MAINTENANCE).

3. Remove the flame arrestor and start the engine. Operate the engine at a fast idle speed (1000-1500 RPM). Use an aerosol-type fogging solution and spray sufficient amount, into the throttle body assembly bores, to treat internal surfaces of the engine. Refer to the instructions on the fogging solution canister. Turn the ignition switch to the OFF position.

4. Clean the flame arrestor and the vent hoses, and reinstall on the engine. Cover the throttle body assembly, to prevent the possibility of the water entering the engine through the throttle body assembly, during storage.

5. Close the fuel shut-off valve (if equipped).

## FRESH-WATER COOLED MODELS

**IMPORTANT:** The fresh-water section of the cooling system must be kept filled year around with recommended coolant. Make certain that the cooling system is protected with an ethylene glycol antifreeze mixture properly mixed to protect the engine to the lowest temperature that it will be exposed to.

See DRAINING FRESH-WATER COOLING SYSTEM in ENGINE MAINTENANCE section for draining and refilling procedures of FWC system, if required.

## BATTERY STORAGE

Follow the battery manufacturer's instructions for storage. If not available, use the following instructions:

- Remove the battery from the boat and clean, removing dirt and grease from the top of the battery.
- Fill the battery with distilled water to the manufacturer's specifications.
- Store the battery in a cool, dry place. Do not store on a concrete surface.
- Periodically (every 30 to 45 days), check the water level and recharge the battery to the manufacturer's specifications. Do not fast charge.

| CAUTION |
| --- |
| A discharged battery can be damaged by freezing. |

## FITTING OUT AFTER STORAGE

When recommissioning the engine after storage, the following items should be checked:

- Check all the cooling system hoses. Be sure they are properly connected and all the hose clamps are tight.

**CAUTION**

When installing the battery, make certain that you connect the POSITIVE (+) BATTERY CABLE to the POSITIVE (+) BATTERY TERMINAL first, and the NEGATIVE (-) BATTERY CABLE to the NEGATIVE (-) BATTERY TERMINAL last. If the battery cables are reversed, the electrical system will be damaged.

**WARNING**

Do not use jumper cables and/or a booster battery to start the engine. Do not recharge a weak battery in the boat. Remove the battery and recharge in a ventilated area away from fuel vapors, sparks or open flame.

- Install the fully charged battery. Be sure that all the connections are clean and free from corrosion. Coat the battery terminal connections with an anti-corrosion battery terminal spray.
- Refer to the OPERATING INSTRUCTIONS section and perform all the safety checks before starting the engine.
- Start the engine and closely observe the instrument panel. Allow the engine to reach normal operating temperature. Inspect the engine carefully for fuel, exhaust, oil and coolant leaks.
- Check the steering and throttle controls for proper operation.

Engine performance complaints usually fall under one of the basic headings listed in the Troubleshooting Guide. When a problem cannot be easily diagnosed, consult a PCM Engines Servicing Dealer for assistance.

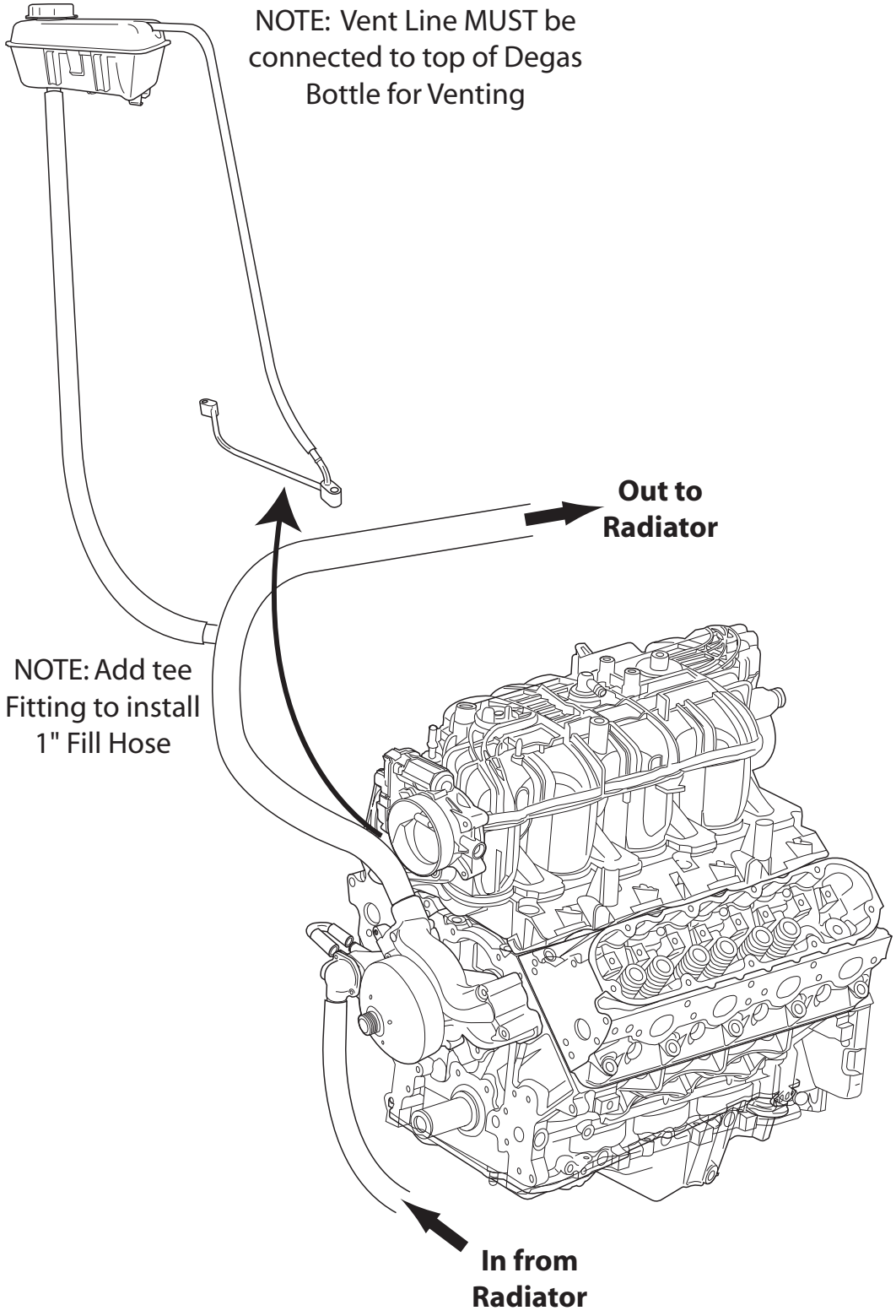
| Malfunction | Possible Cause | Corrective Action |
|---|---|---|
| **Engine will not crank with the starter motor, or cranks slowly.**<br><br>**NOTICE:** Battery voltage must be AT or ABOVE 10 volts while the engine is cranking or the engine management system will not function. | Problem with the engine management system. | Contact PCM Engines Dealer. |
| | Battery switch turned OFF (if equipped) | Turn the battery switch ON. |
| | Remote control not in Neutral position. | Position the remote control exactly in Neutral. |
| | Blown the ignition fuse or open circuit breakers. | Replace the fuse - reset circuit breakers. |
| | Loose and/or dirty wiring connections. | Check the battery cables and starter circuit wiring. Clean and tighten all connections. Repair or replace the damaged wiring. |
| | Dead Battery | Recharge, test and replace as necessary. |
| **Engine Cranks - will not start or is hard starting.**<br><br>**NOTICE:** Battery voltage must be AT or ABOVE 10 volts while the engine is cranking or the engine management system will not function. | Improper starting procedure. | Refer to “STARTING ENGINE” in the OPERATING INSTRUCTIONS section. |
| | No fuel - empty fuel tank | Check the fuel tank level - fill tank(s). Open shut-off valve(s). |
| | No fuel to the throttle body (TBI) or the injectors (MPI) | Plugged fuel filters.<br>Plugged or kinked fuel lines or plugged fuel-tank vent.<br>Faulty fuel pump - check electrical connections.<br>Faulty anti-siphon valve. |
| | Engine flooded | Open the throttle 100% and crank the engine. When the engine starts, immediately return the throttle to 1000 RPM. |
| | Ignition system malfunction | Contact PCM Engines Dealer. |
| | Contaminated fuel | Check fuel for water or other contamination. If contaminated, drain and clean the fuel system. |

# TROUBLESHOOTING - 14

| Malfunction | Possible Cause | Corrective Action |
|---|---|---|
| **Engine Overheats** | Loose or worn drive belt(s) | Adjust or replace the belts as necessary. |
| | Collapsed, kinked or leaking hoses. | Replace the hoses. |
| | Faulty thermostat | Replace the thermostat. |
| | Faulty temperature sending unit or gauge | Test and replace as necessary. |
| | Coolant level low in the fresh-water section of the cooling system | Check the cooling system for leaks. Refill the system. See Warning before removing the fill cap. |
| | Improper coolant mixture | Install the proper coolant mixture (50% antifreeze - 50% water). |
| **Insufficient engine temperature** | Faulty thermostat | Replace the thermostat. |
| | Faulty temperature sender | Replace the temperature sender. |
| **Engine oil pressure low** | Faulty oil pressure sending unit or gauge | Test and replace as necessary. |
| | Oil level low | Add specified oil. Check the engine for leaks. |
| | Crankcase overfilled causing oil aeration | Remove the required amount of oil. Determine the cause of overfilled condition (improper filling, etc.). |
| | Diluted or improper grade/ viscosity of oil | Change the oil and filter. Determine the cause of dilution. (insufficient engine temperature, excessive idling, etc.) |

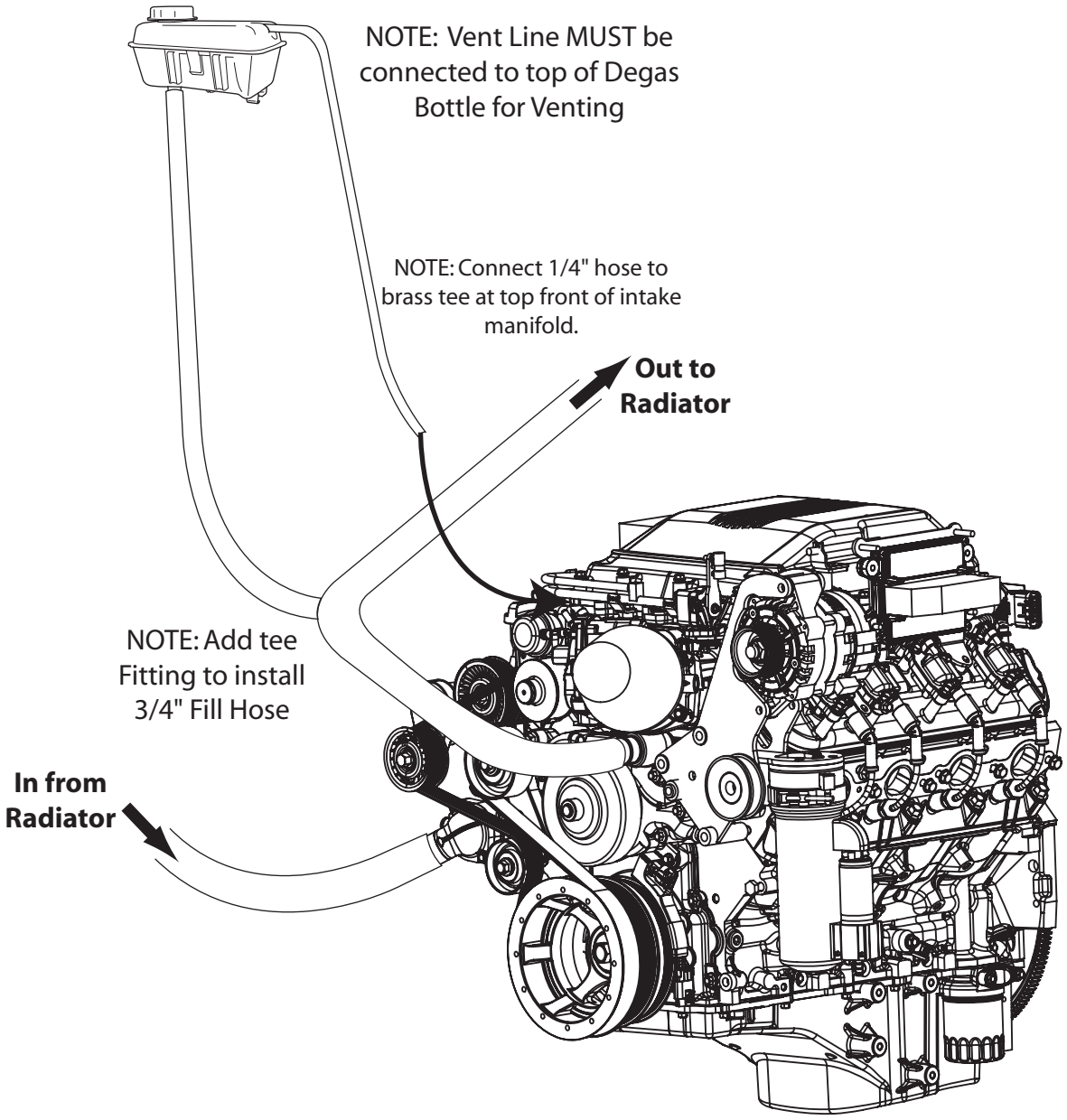
| Malfunction | Possible Cause | Corrective Action |
|---|---|---|
| **Engine misses, runs rough and/or backfires** | Ignition system malfunction | Contact PCM Engines Dealer. |
| | Plugged fuel filters | Replace the fuel filters. |
| | Faulty fuel pump. | Have fuel pump replaced by a PCM Engines Dealer/ |
| | Plugged or kinked fuel lines or fuel tank vent | Repair or replace the fuel lines. Remove obstruction. |
| | Anti-siphon valve faulty | Clean or replace as necessary. |
| | Flame arrestor dirty | Clean the flame arrestor. |
| **Poor engine or boat performance** | Ignition malfunction | Contact PCM Engines Dealer. |
| | Throttle not fully open | Check the remote control and throttle body linkage for freedom of movement and proper adjustment. |
| | Damaged or improper propeller | Repair or replace as necessary. |
| | Excessive water in the bilge | Pump the water out and investigate source of entry. |
| | Excessive growth on the boat bottom | Clean the bottom and paint with an anti-fouling paint. |
| | Boat overloaded | Reduce and/or redistribute the load. |
| | Dirty flame arrestor | Clean the flame arrestor. |
| | Engine overheating | Repair the cooling system (See “Engine Overheats”). |

# COOLING SYSTEM DIAGRAM - 15

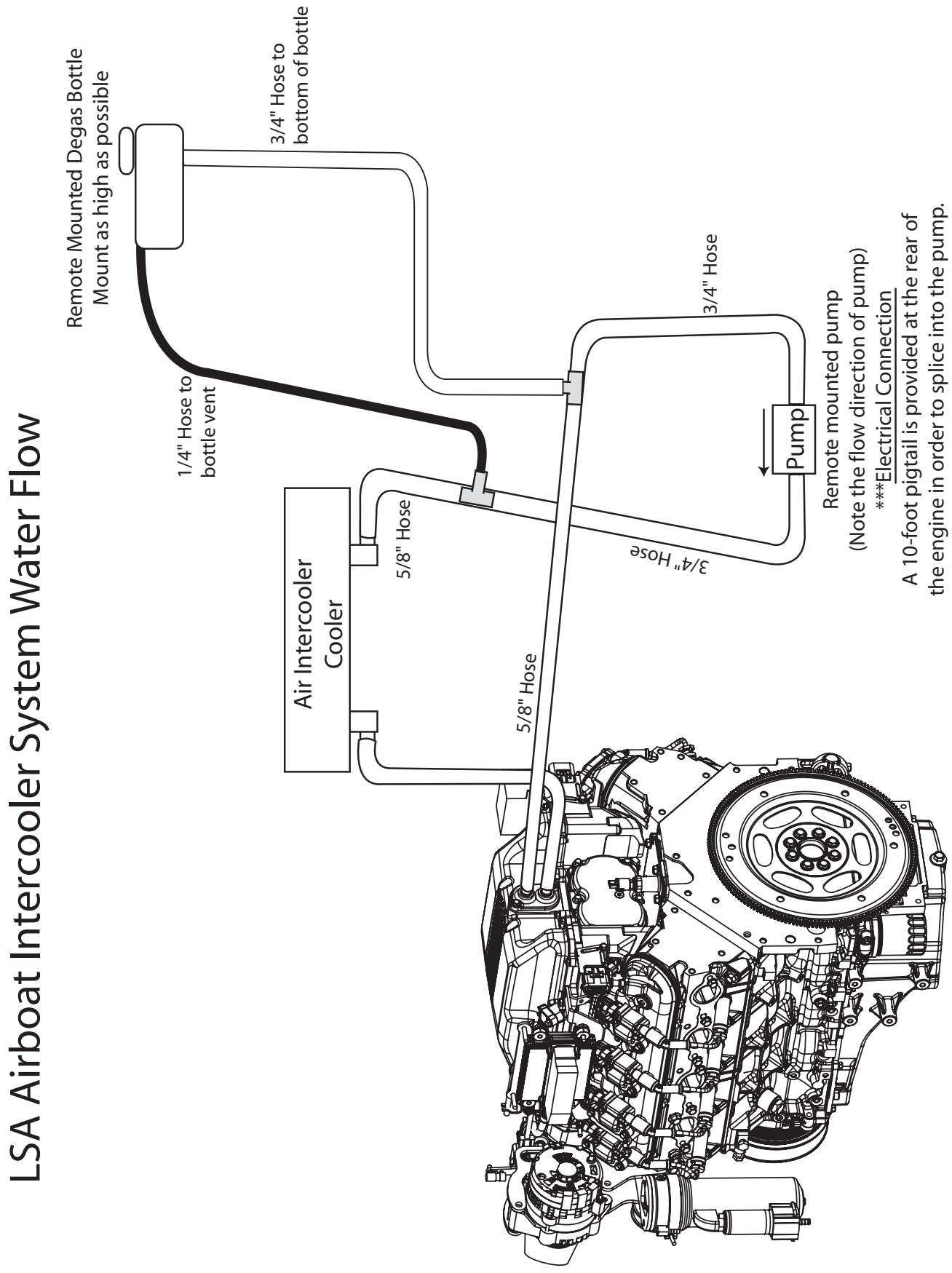



***6.0L HO***

# LSA Airboat Cooling System Water Flow




***6.2L Supercharged Cooling System***




***6.2L Supercharged Intercooler Cooling System***

**NOTE: ENGINE HARNESS WIRED FOR PANELS USING VOLTMETERS ONLY.**

**NOTE Ⓐ: POWER FOR A FUSED ACCESSORY PANEL MAY BE TAKEN FROM THIS LOCATION. LOAD CANNOT EXCEED 30 AMPS.**

**2-PIN WIRE HARNESS COLOR CHART**

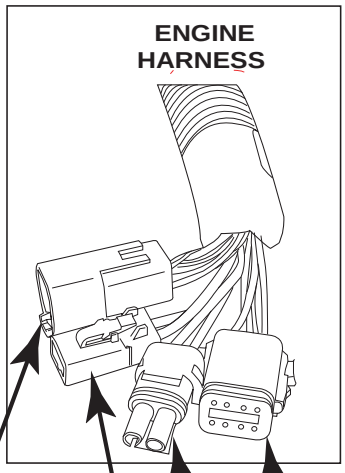
| CIRCUIT NUMBER | CIRCUIT NAME | ENGINE HARNESS WIRE COLOR |
|---|---|---|
| Ⓐ 1. | VBAT | RED/PURPLE |
| 2. | GROUND | BLACK |

**6-PIN WIRE HARNESS COLOR CHART**

| CIRCUIT NUMBER | CIRCUIT NAME | ENGINE HARNESS WIRE COLOR |
|---|---|---|
| 1. | | PLUG |
| 2. | | PLUG |
| 3. | | PLUG |
| 4. | | PLUG |
| 5. | CAN HI (+) | BLACK/WHITE |
| 6. | CAN LO (-) | WHITE |

**8-PIN WIRE HARNESS COLOR CHART**

| CIRCUIT NUMBER | CIRCUIT NAME | ENGINE HARNESS WIRE COLOR |
|---|---|---|
| 1. | *CHECK GAUGES LAMP | GRAY/BLACK* |
| 2. | TACHOMETER | GRAY |
| 3. | COOLANT TEMP | TAN |
| 4. | BUZZER | TAN/BLACK |
| 5. | IGNITION | PURPLE |
| 6. | MIL | GREEN/YELLOW |
| 7. | STARTER | YELLOW/RED |
| 8. | OIL PRESSURE | DARK BLUE |




6-PIN CAN BUS CONNECTOR

2-PIN BOAT HARNESS CONNECTOR

FUEL TANK FUEL LEVEL CONNECTOR

8-PIN BOAT HARNESS CONNECTOR

***Figure 16-1*** Typical Instrumentation Wiring - ECM-08

# LITERATURE - 17

To obtain service and/or parts literature for your PCM Marine Engine, contact the following:

Pleasurecraft Engine Group
Publications Department
1737 Highway 76 East
Little Mountain, SC  29075

1. SERVICE: For more detailed information, PCM has a detailed service manual available. This manual contains complete engine and component disassembly and reassembly instructions. Troubleshooting and maintenance charts are also included.

2. PARTS: Parts manuals with exploded views for service parts are available for all current engine models.

IMPORTANT: When contacting the factory for service information, be sure to include your engine model and serial number to insure the service information you receive is correct.

## OPERATION AND MAINTENANCE LOG

| | | | | | |
|---|---|---|---|---|---|
| Engine Model and Serial # | Port _____ Stbd. _____ | Drive Serial # | Port _____ Stbd. _____ | Ignition Key Number | Port _____ Stbd. _____ |

| Fire Extinguisher Checked | Batteries Tested |
|---|---|
| | |

| Runs Made | Date | Gal of Fuel | Qts of Oil Port | Qts of Oil Stbd. | Miles | Hours | Oil Change | Check Drive | Lay Up Date | Launch Date | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|
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## PROBLEM NOTIFICATION OR INFORMATION REQUEST FORM

**IMPORTANT:** All blanks MUST be completed to insure proper identification of your engine which is necessary to properly understand your request.

When completed, mail this form to:

Pleasurecraft Marine
PO Box 369
Little Mountain, SC 29075

Engine Model _____ Engine Serial Number _____ Gear Serial Number _____

### Owner Information

Name _____ Telephone (  ) _____

Address _____

City _____ State _____ Zip _____

Selling Dealer _____

Dealers Address _____

Date of Purchase _____ Boat Make _____ Length _____ Type _____

Gentlemen, I would like to inform you of a problem I have experienced with the above engine. My problem is:

My boat is located at _____

Address _____ Telephone (  ) _____

City _____ State _____ Zip _____

Requestors Signature _____ Date _____

# PLEASURECRAFT MARINE ENGINE CO.

## LEVITATOR ENGINE
## LIMITED ENGINE WARRANTY

Pleasurecraft Marine Engine Co., Inc. (hereinafter PCM) extends to the purchaser of each new marine base engine supplied by PCM to an authorized PCM dealer a LIMITED WARRANTY for a period of 200 hours of operation or twelve (12) calendar months, six (6) calendar months in commercial use, FROM THE DAY OF DELIVERY REQUIRED TO BE ENTERED BELOW AT THE TIME OF DELIVERY TO THE PURCHASER. This warranty is applied in the same manner and under the same conditions as the LIMITED WARRANTY which covers all new marinized PCM engines, COPY AVAILABLE UPON REQUEST, with the following exceptions:

1. PCM will reimburse or credit the customer for the repair or replacement under this warranty for any part which in the opinion of PCM is found to be defective, in the following manner.

A. Parts: Reimbursement or credit for parts used in the repair of covered items on any base engine covered by this warranty, will be paid at PCM's current published dealer net price of such a part.

B. Labor: Reimbursement or credit for labor performed in the repair of covered items on any base engine covered by this warranty will be paid in accordance with the published Chevrolet or Ford bench flat rate labor repair time figured at PCM's normal labor rate as agreed upon with the dealer prior to repair.

2. The person making repairs under this warranty must receive prior authorization from PCM before repairs are made to any failed base engine. Major failures may require inspection at PCM facility or by their designate, prior to replacement.

### THIS WARRANTY DOES NOT COVER THE FOLLOWING:

1. Failure resulting from any outside source not a part of the base engine, including but not limited to, parts transferred to or added to the base engine or add-on items or parts, accessories, controls, etc. or any other item which in the opinion of PCM adversely affects the performance or reliability of the base engine whether such item is assembled to, or in any other way involved in the operation of the final configuration as installed in the purchaser's application of the base engine.
2. Engines used in applications other than marine use, not approved in writing by PCM prior to the delivery are not covered by this warranty.
3. Labor for removal or reinstallation of the engine in the boat and /or labor for removal or reinstallation of add-on parts in or out of the boat are not covered by this warranty.
4. Any and all items not covered by PCM complete engine warranty are not covered by this warranty. (Copy available on request.)
5. Engines not registered upon sale as required below are not covered by this warranty. The purchaser is required to sign this warranty registration at the time of purchase and return to PCM at the address listed within ten (10) days of purchase to validate this warranty.

---

## BASE ENGINE DELIVERY RECORD / WARRANTY REGISTRATION

ENGINE MODEL NUMBER: _____ SERIAL NUMBER: _____

SELLING DEALER: _____

ADDRESS: _____

CITY STATE ZIP: _____

DEALER SIGNATURE: _____

CUSTOMER: _____

ADDRESS: _____

CITY STATE ZIP: _____

PHONE: _____

After reading the above warranty statement and entries, the provisions of which I understand and accept, I now affix my signature below, as purchaser, in proof of receipt of this base engine and acceptance of the above warranty provisions:

CUSTOMER SIGNATURE: _____ DATE: _____

**IMPORTANT:** MAKE COPIES OF THIS COMPLETED FORM. ONE COPY FOR THE OWNER, ONE COPY FOR THE DEALER AND ONE COPY TO THE DISTRIBUTOR.

MAIL TO: PLEASURECRAFT MARINE ENGINE CO., P.O. BOX 369, LITTLE MOUNTAIN, SC 29075

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